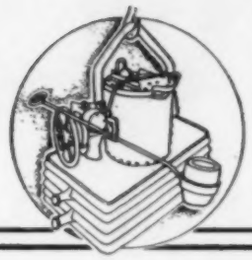

The Foundry

VOLUME 65 • NUMBER 10

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The Foundry

Wages and Hours Bills Need Discussion

PASSAGE of wages and hours legislation at the next session of congress seems probable. The trend is in that direction and only the confusion of the court battle prevented enactment of the law at the last session after a bill had been passed by the senate and reported by the house committee on interstate commerce.

Some observers believe an effort will be made to incorporate fair trade practices with the bill when it again comes up for consideration. While information on the several bills now being prepared is indefinite, it is believed the trade practice features will provide for voluntary agreements for various industries. Much of present talk is reminiscent of old NRA.

Certain objectives of the proposed legislation are fair and have the approval of industrialists. Other features are dangerous and demand attention. With the majority of senators and congressmen visiting the home districts, foundrymen now have an opportunity of discussing the proposals with their elected representatives. It also has been suggested that an invitation to visit the plant be extended the representatives. The visit might prove enlightening to your representatives and beneficial to industry.

Training Survey

INTERESTING statistics on efforts of industry to improve the productive capacities of the working population of this country are contained in a recent survey of the National Industrial Conference board, and published under the title "Training for Industry."

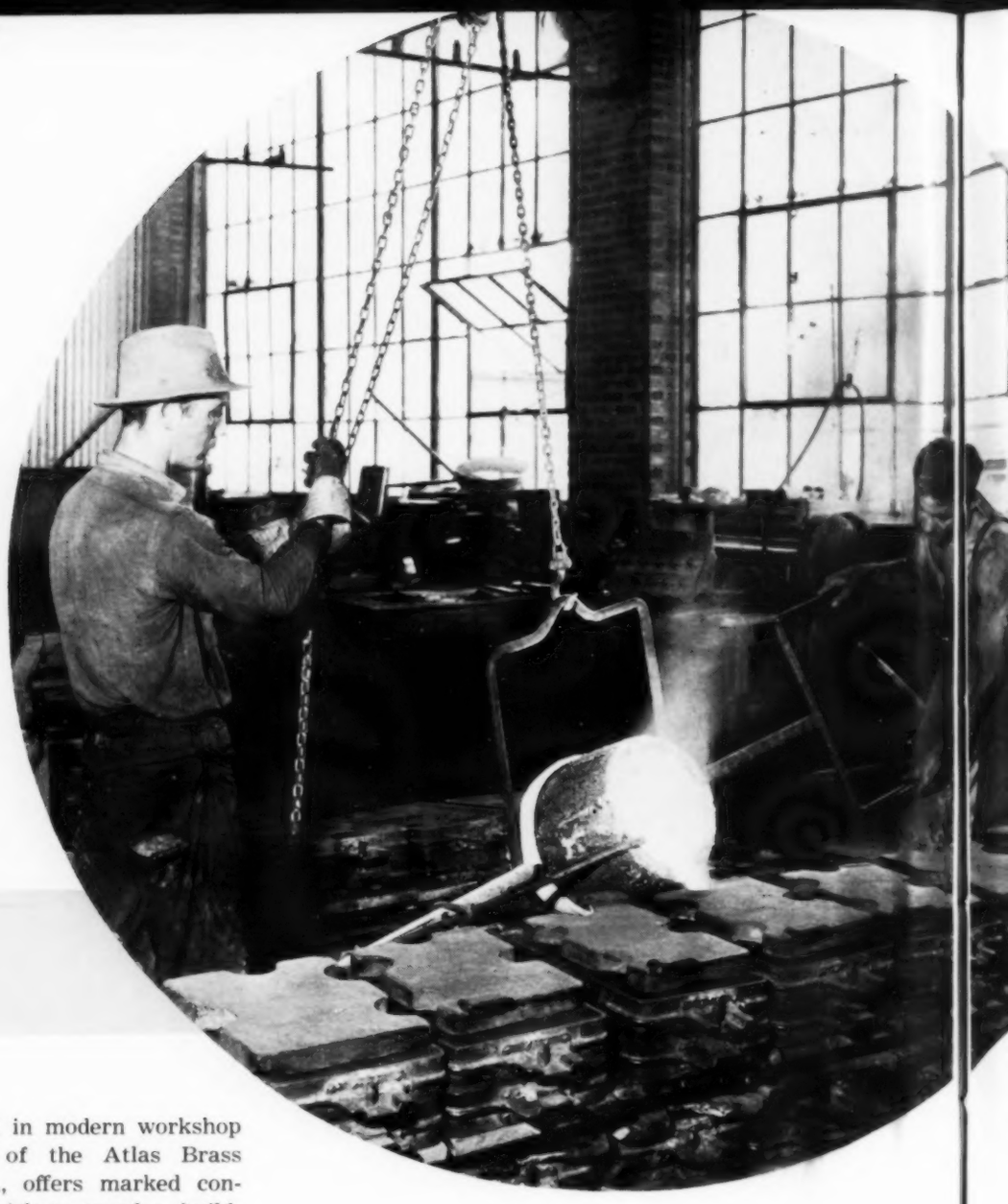
Definite proof of a shortage of competent skilled labor, especially in the metal working industries, is presented. Reports from 404 companies in that field employing a total of 467,197 workers, reveal that 21.4 per cent of the companies have sufficient skilled labor, 26.5 per cent are experiencing a serious shortage of such workers, and 52.2 per cent find it impossible to secure competent craftsmen to fill the jobs that are open. The list of occupations in which the greatest shortage exists includes molders.

Educational work in preparing men to meet industrial needs may be carried on by industry alone, by educational institutions, or by a combination of both. Where the training is provided by industry alone, the survey shows the following three methods are employed: 1—Training on the job where the youth works with an experienced craftsman under the supervision of the foreman; 2—Vestibule school where a part of the plant is set aside for training purposes. Machinery, equipment and instructors are provided and the learner is given intensive training, usually in a particular occupation; and 3—Apprentice training under an oral or written agreement between company and apprentice covering the course to be provided, the length and character of training and the compensation paid by the company.

Foundrymen should be especially interested in a portion of the study which pertains to apprentices. While the survey shows that four out of five companies reporting have a definite training policy, only 57.5 per cent of the companies included in the summary provide regular apprentice training programs. Assuming that the survey covers companies of large or medium size, this percentage probably reflects conditions in that class of plants in the foundry industry.

Of the companies reporting apprentice training programs, 55 per cent provide all instruction and 45 per cent utilize some outside facilities, usually for school room instruction. The average compensation for apprentices ranges from approximately 33 cents an hour for the first six months to 57½ cents an hour for the last half of the fourth year.

Frank G. Steinebach
Editor



By PAT DWYER

FAIRLY typical of the trend in modern workshop construction, the foundry of the Atlas Brass Foundry Co., Columbus, O., offers marked contrast to the smoky, low roof, rickety wooden buildings in which brass castings often were produced in the so called *good old days*. Where in the early morning and late afternoon the men crept around like so many denizens of the under world in the dim and flickering light of a few smoky and horribly smelling oil torches. In summer a handful of scattered spears of daylight flowed in bravely through broken panes in the skimpy windows. When these openings were stuffed in winter with gunny sacks and old overalls, even the light of the noon day sun scarcely could filter feebly through the remaining grimy panes. A proper owl's nest.

Old molders flourished for an incredible number of years, growing lighter year by year and finally blew away like so many puff balls. Unfortunately, none of the narrators of this hoary old tradition is willing to come out flat footed and say that he actually has witnessed an incident. The young and earnest seeker for the truth, stop watch and slide rule in hand, probably will find that the story is just another one of the playful exaggerations to which foundrymen always have been addicted in moments of ease and relaxation. The brass foundry always has been a fertile field.

Ignoring for the moment the puff ball legend, the fact remains that the old time brass molder had no opportunity of going soft or of developing into a weakling through petting or coddling. Needless to say, the term petting is used in the early 1900 or original sense and not in the perverted sense to which the cheerful and moronic majority has reduced it since the war.

In the typical old time brass foundry the sand heaps dried out in the summer with the result that sand dropped from the copes or washed before the metal. In winter the sand was frozen and after it was thawed with hot plates or by piling it around a salamander, it stuck to the frozen patterns. In rainy weather the roof leaked like a sieve, or perhaps more properly speaking, a half inch riddle. Molds either had to be covered with old bags and bottom boards, or constantly shifted from place to place to escape the drip. The molders were kept so busy hopping from one duck board to another, they had no time to grouse over such minor grievances as long hours, foul air, dust and open air plumbing.

Brass foundries erected in recent years, and typified

Skill Needed in Brass Foundry

by the foundry of the Atlas Brass Foundry Co., present startling and highly gratifying contrasts to the old.

In this Columbus, O., plant ample light is secured through continuous windows around three sides of the building and extending from near the floor level to the eaves of the roof. The fourth side of the building is in immediate proximity to the battery of furnaces and is more or less temporary to facilitate further expansion. The wall is made up of hollow concrete blocks attached to the steel frame. The remainder of the building, the low wall underneath and the pillars between the windows are brick on a concrete foundation.

The furnace room, shown in Fig. 5, is separated from the remainder of the foundry by a corrugated sheet steel partition. In this manner the gas and smoke from the furnaces are confined in a limited area and do not contaminate the atmosphere where the majority of the men are employed. The furnaces are fired with natural gas, a form of fuel which produces a minimum amount of smoke and this relatively small amount combined with the heated air above the furnaces is exhausted through a revolving fan set high up in the wall at each end of the furnace department. At the present writing plans are in contemplation for an exceptionally complete dust collection and air conditioning system for the entire foundry including the furnace department.

A program of change and improvement based on operating experience has characterized the policy of the company since the plant was erected and placed in operation several years ago. For example, in the original installation the furnaces were set above the floor level and near the center of the foundry. Many good reasons supported this form of installation, including proximity to the various molding floors. Later study exposed many flaws in the plan. Excessive time and labor were involved in handling the raw materials and later in lifting the pots and lowering them to the shanks resting on the floor. Handling pots of molten metal at that height, with the ever present risk of one collapsing, introduced a hazard that could not be tolerated in any safety first program.

A concrete lined pit approximately 3 x 5 x 20 feet was constructed near one end of the building and the five furnaces equipped with special burners made by the Campbell-Hausfeld Co., Harrison, O., were set up in such a manner that the tops project only a few inches above the floor level. Short pieces of rails set in slots in the walls and extending from side to side support the steel plates on which the operators stand while charging the furnaces and while removing the pots of molten metal.

A light chain hoist suspended from a jib crane located close to the furnace in the center of the group, is utilized in lifting the crucibles. The jib of the crane is long enough to deposit each loaded crucible on a low concrete block. Here the crucible is skimmed and then carried away in a shank attached to a chain hoist and suspended from a monorail which through branches and connections covers the entire foundry floor. The metal is handled so rapidly that the distance from the furnaces, as compared with the former location, is not a factor of any importance.

Each furnace is served by a small motor driven blower which delivers air and gas in predetermined volume. The various units, as shown in the illustration, are located on the floor immediately back of the furnaces and therefore easily accessible for adjustment and operation. From the blower and mixed air and

Fig. 1 (Above at left)—Molds are stacked two-deep on inclined skids. Fig. 2 (Below)—Typical pattern plate, also cope and drag molds for pump impeller castings

gas passes through a pipe to the special burner near the bottom of the furnace. The burner is set at a tangent and the flame whirls around the crucible. The top of the furnace is covered with a refractory lid counterweighted and pivoted at one side.

The lid is swung to one side for insertion and removal of the crucible and for reception of the first charge. The lid then is closed and as the metal sinks down, additional material is charged through a small opening in the center of the lid. The flame playing through the opening raises the metal almost to the melting point before it sinks into the molten metal in the crucible. The furnaces are uniform in size for accommodation of a No. 90 crucible. According to the American system of grading crucibles, the capacity for red or yellow brass is 3 pounds to the number. For example, a No. 60 crucible holds 180 pounds, a No. 70 holds 210 pounds, and in the present instance a No. 90 crucible has a capacity of 270 pounds of metal. With an average of six heats per day from each pot, the total amount of metal melted daily is approximately 8000 pounds, about equally divided between red and yellow brass.

In a small valve cock which the company manufacturers in considerable volume, a slight variation in the zinc content will cause the valve to leak under pressure. Here as in other links in the cycle of operation, empirical knowledge of the operator supplies the necessary check. In the adjoining machine shop, skilled turret machine operators immediately spot potential leakers. Although apparently perfect, the manner in which the casting responds to the tool informs the operator that it is not up to standard. He may not be able to explain *how* he knows, any more than a molder can explain how he can determine the quality of molding sand by squeezing a ball in his hand, but he knows, and all the castings from that particular batch are rejected and returned to the furnaces.

The Atlas Brass Foundry Co., specializes in the manufacture of small gear and centrifugal pumps, also valves and fittings. The machine shop is fitted in special manner to machine and assemble these units on a production basis. Detailed description of the many ingenious conveyors, mechanical devices and method of routing the work through this department, although extremely interesting, lies outside the scope of the present article dealing exclusively with some of the features in the foundry. (*Please turn to page* 81)

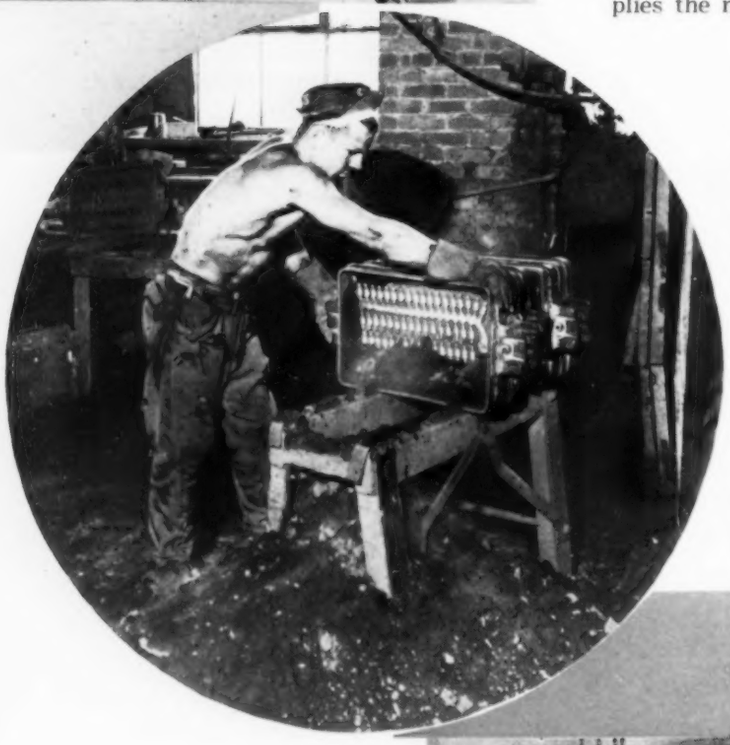


Fig. 3 (Top)—Metal is conveyed to all floors on a monorail system. Fig. 4 (Center)—Each floor is provided with a substantial trestle on which the molds are shaken out. Fig. 5 (Bottom)—Battery of furnaces located in single pit below floor level

Gating Nonferrous Castings

By N. K. B. PATCH

Fig. 1 (Left)—The metal flows down into each mold cavity and will not leak back. (Right)—Gate at the top edge insures feeding metal in the heavy stem

TO PREVENT confusion, let us first define the different terms used in describing gating practice in the foundry.

Sprue, Fig. 1 (Right). A vertical opening through the cope of the mold through which the metal passes down to the runner or gate.

Runner, Fig. 2. A passage cut or molded in the sand, through which the metal runs from the sprue to the gate or gates leading into the mold cavity.

Gate, Fig. 3. An opening through which the metal is led directly into the mold cavity, or into the risers, or both.

Riser, Fig. 4. An opening provided for the storage of fluid metal in such a position that it flows through force of gravity into the casting as it solidifies and thus compensates for the metallic shrinkage during cooling. In other words it performs the function of a feeder.

Shrink ball, Fig. 5. A special type of riser, which does not necessarily have any opening to the outer air at the top.

Horn gate, Fig. 6. A type of gate or runner so constructed that the metal dips down and then rises up into the mold cavity. This type of gate usually tapers sharply throughout its length so that the gate pattern may be removed readily by rolling it out of the sand. However, some horn gates are shaped in the form of any desired bend and are made in cores. Two halves are pasted together, after which the core is located in the mold, as shown in Fig. 6A.

Skim gate, Fig. 7. A legion of different designs of gates are known as skim gates. Their usefulness frequently is debated but certainly they cause a definite restriction in the flow of metal. In some instances they separate some of the scum (*Please turn to page* 95)

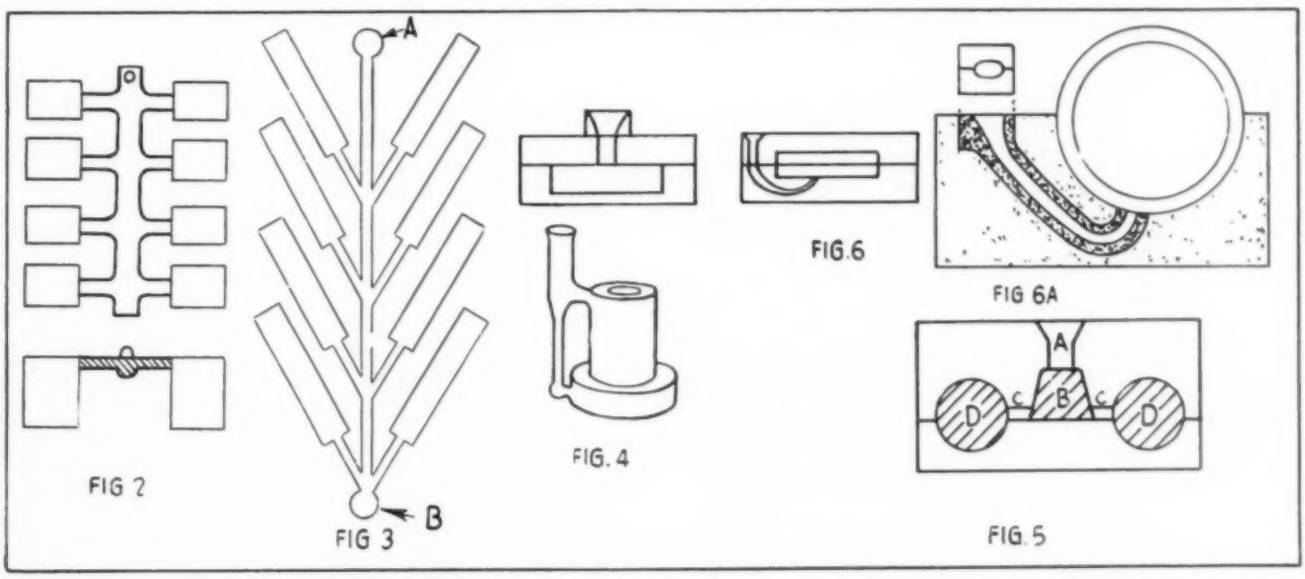


Fig. 2—Conventional arrangements showing plain runner and gates. Fig. 3—The sprue may be at the high end A or the low end B. Fig. 4 (Above)—Conventional type riser in cup. (Below)—Riser and gate combined. Fig. 5—Runner B and gates C are located in the cope. Fig. 6—Simple application of horn gate. Fig. 6A—Special type horn gate formed in two half dry sand cores

Fig. 9—As soon as the operator has dumped the sand into the flask he pushes a button and the machine is jolted a definite number of times through an electrical timing device. When jolting ceases the operator pushes another button which operates the squeezing mechanism, and a definite squeeze is given to the sand in the mold

Automotive

By EDWIN BREMER

MOLDING operations in the Saginaw Malleable Iron division, General Motors Corp., Saginaw, Mich., are conducted on three continuous molding units of which only one will be described. It is known as the *A* unit, and was installed much later than the other two. Only synthetic sand is employed in the foundry. As mentioned in a previous article which appeared in the September issue of THE FOUNDRY, that sand is based upon the core sand employed.

Preparation of the molding sand is a part and parcel of the molding unit, and it will be well to start at that point. The molding sand used in the system is composed of 4 separate components which are contained in storage hoppers mounted under the roof. One hopper contains spill sand which is conveyed by belt from the molding unit. Another contains sand from the shakeout unit. A third contains sea-coal while the fourth holds burnt sand from the cleaning room which has been mulled with clay.

Located Over Conveying Belt

The four storage hoppers are located in a line over a sand conveying belt. Material from each of the storage hoppers is fed onto the conveyor by vibrating feeders, except in the case of seacoal, which is fed by screw. The conveyor belt unloads into a continuous sand mixing unit. From the mixing unit the sand is carried by belt to two 100-ton capacity storage tanks which are used alternately.

While one hopper is being filled, sand from the other is being fed to the molding system. Sand is distributed from the hopper on a traveling conveyor belt by a rocking table feed. The belt discharges the sand into a revivifying unit. From the revivifying unit, the sand is conveyed to the bins or hoppers over the molding stations.

Molding sand is subjected to extremely careful control, and especially so as to moisture content. Tests are taken every hour on the sand leaving the revivifying unit for moisture, permeability and bonding strength, and the operator in charge endeavors to maintain the moisture content within plus or minus 0.10 per cent of the desired point. To insure as close control as possible the operator is paid a bonus for his ability to hold the moisture within the proper range. In addition to the hourly tests on the feed-in sand, similar tests are performed on sand taken at the molding stations about 3 or 4 times per shift.

The molding unit, shown in Fig. 10, is termed a 2-

Malleable Castings Made on Continuous Molding Units

plane, antifriction type mold conveyor. The unit is 208 feet long from the centers of the driving and idle sprockets, and is 8 feet wide from center to center. Molds are carried on tables 6 feet 9 inches long and 24 inches wide which are attached to the chain near their outside edges.

Arrangement of the conveying unit is such that the height of the mold carrying tables varies above the floor level at several points, including one where it travels below the floor level. Reasons for different levels of the tables are to place them at the best position for the molders. For example where the drags are placed on the conveyor, the table height is 24 inches above the floor level. Then it drops down to about 14 inches where the cores are set and the copes put on. At the pouring side the table and floor levels are the same. After pouring the tables go below the floor level during cooling. That permits cores, etc. to be brought in without having to climb over the conveyor.

Units Operated Synchronously

At the shakeout end, shown in Fig. 13, two overhead conveyor chains carry cope and drag flasks respectively to molding machines. Molding conveyor and the flask conveyors are operated synchronously so that if a tie-up occurs any place, all lines stop. The flask return conveyor operates at a speed so that as either a cope or drag is finished, a flask for the next is just opposite the machine.

Molding machines on the unit are of the jolt-squeeze, stripping type. While the unit contains 15 machines, usually only 10 are in operation at any one time—half on copes and half on drags. The extra machines are being set up on new jobs. That gives considerable flexibility since when any particular job begins to run out, some of the operators can be shifted to the new work without any delay, and the machines that they had been working on then can be changed.

Operation of the molding machine is entirely automatic except for placing the flask in position, dumping in sand from the overhead hopper, and removing the completed mold. As soon as the operator has dumped the sand into the flask, he pushes a button, as shown in Fig. 9 and the machine is jolted a definite number of

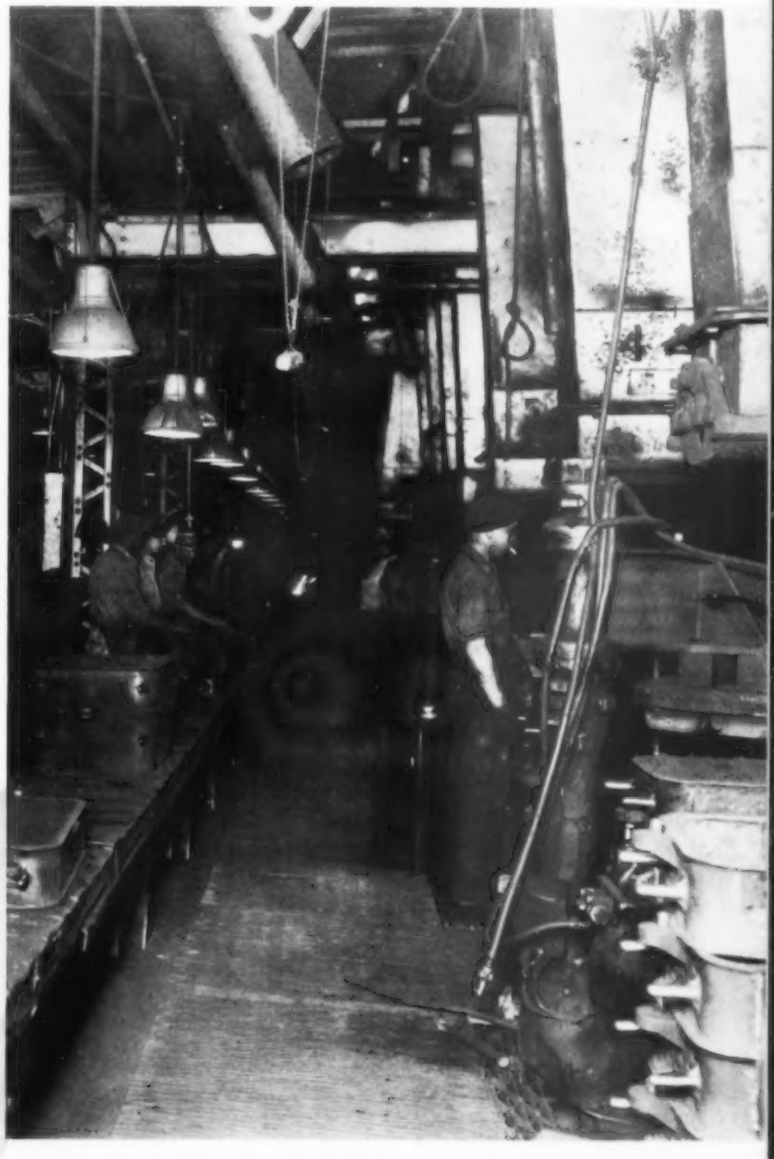


Fig. 10—A view of the molding unit from near the shakeout end. Pouring is performed at the opposite end as may be observed faintly in the distant background. The men at the left are setting cores

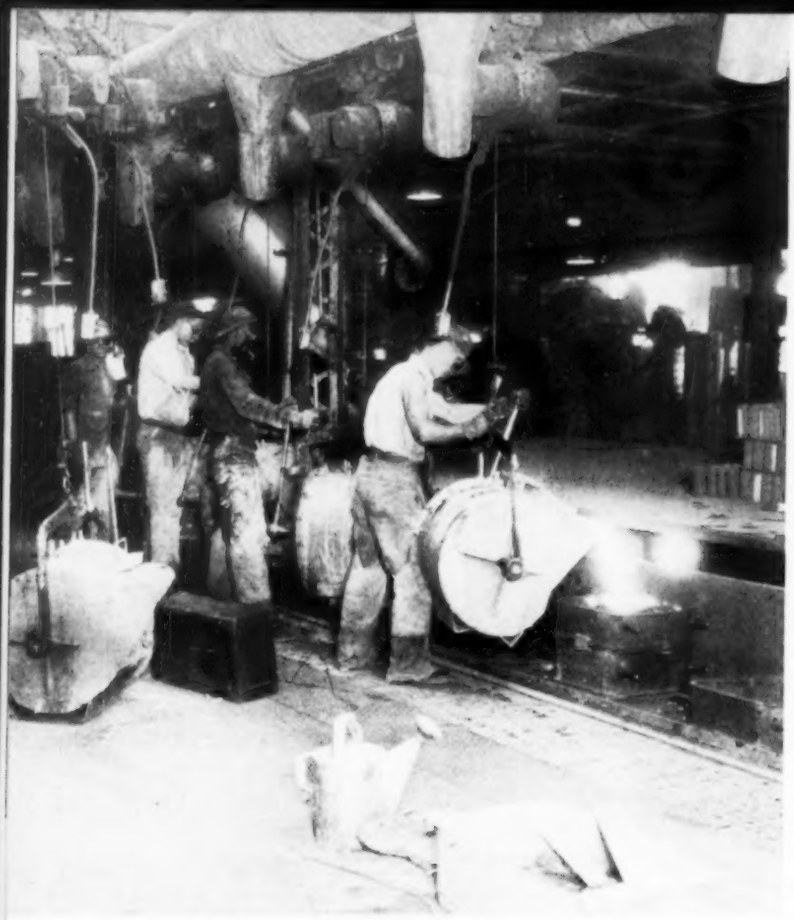


Fig. 11—Men at the pouring station stand on a moving platform which is synchronized with the travel of the mold conveyor. Hence, the operators can devote their entire attention to pouring, and see that the molds are filled properly

Fig. 12 (Below)—Hot metal from the mixing ladles at the cupolas is tapped into 3-ton covered traveling ladles suspended from an overhead track. Those ladles transport the molten metal to the back of the electric furnaces

times through an electrical timing device. When jolting ceases, the operator pushes another button which operates the squeezing mechanism, and a definite squeeze is given to the sand in the mold. The squeeze is controlled by the pressure built up in the cylinder. Following that operation the mold is removed to the conveyor. Drag molding machines are first in the line for obvious reasons.

Pouring, as shown in Fig. 11 is performed from a moving platform which travels in the same direction and at the same speed as the mold conveyor. Consequently, no difficulty is encountered in filling the molds properly. As may be observed in that illustration covered pouring ladles are employed. Not only are those ladles covered, but also the transfer ladles used to transport the iron from the electric furnaces to the pouring stations.

Make Numerous Test Bars

Every half-hour at the pouring station 6 test bars are made from one ladle. The bars ⅞-inch square and 7 inches long are made 6 in one mold. Each bar contains information on the month, day and hour it is poured. Some of the bars are analyzed chemically, others are broken to examine the fracture, and still others are run through the annealing kilns with castings from the same lot of iron.

Iron used for pouring castings is melted by the duplex process employing four cupolas and two electric furnaces which are used alternately. While only two cupolas are being used at one time, the same is not true of the electric furnaces which of course are operated continuously. However, the term alternately is used in the sense that while the charge in one furnace is being heated up to the desired temperature, molten metal is being tapped from the other. Consequently, there is no waiting for metal. (*Please turn to page* 92)

Good Cores Depend Upon Knowledge of Many Factors

By R. E. APTEKAR
American Brake Shoe & Foundry Co.,
New York

This is the second of a series of two articles from a paper presented at the fifth annual foundry conference at Michigan State College, East Lansing, Mich. The first of the series appeared in the September issue

FREQUENTLY it is necessary to produce exceedingly fine finish or complete freedom from sand imperfections on the core. In such a case a wide variety of core coatings have been developed to protect the cores. Thus it is possible to make a comparatively weak and highly permeable core mixture of coarse grain sand and still produce an excellent surface.

Such core coatings are of two general types, those having as a base carbonaceous materials, and those with a mineral base. The carbonaceous coatings may consist of pulverized anthracite coal with small quantities of clay, with bentonite or cereal to increase their cohesion; or graphite or charcoal may be substituted for part or all of this anthracite. The mineral base materials may consist of mica schist, talc, or silica flour. Recent patents have been granted on the use of special coating mixtures, one of them consisting of calcium carbonate and sodium silicate in the proportion of 12 parts of sodium silicate to one part of calcium carbonate.

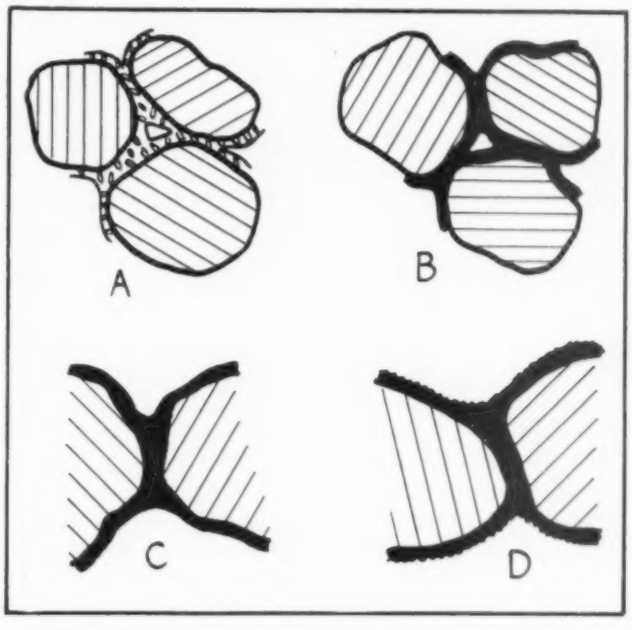
Another patent covers the use of an organic silica ester, the organic portion of which volatilizes, leaving a highly refractory silica jell to bond and protect the surface. All of the commonly used core coatings listed are made by suspension in water and are applied to the core best after baking with a subsequent drying operation. These coatings should be made up to densities varying from 25 to 32 degrees Beaume. The mineral washes have the advantage of being more gas free than the carbonaceous core coatings but they do not in general give quite as polished a core surface.

The quality of cores and the mix used to make them are determined to a large extent by the core making equipment. In mixing straight sand and oil mixtures, paddle type mixtures or gyratory riddles have proved satisfactory. With proper mulling, it is possible to more than double the green strength of a core mix containing cereals.

Use of mixtures of fine and coarse sand and the admixture of cereal with oil makes possible preparation of complex core shapes which it would be impossible to make in a straight sand and oil without proper dryers. Such dryers are an essential part of the production of cores where extreme accuracy is required.

Material progress has been made recently in development of core ovens. The old type stationary coke fired core oven still is functioning in many foundries but it is being replaced gradually by the modern oil or gas fired, automatically controlled core ovens with balanced draft and recirculatory systems equipped with outside combustion chambers. The convection type oven in which the combustion chamber was at the side or bottom radically improved baking conditions but the trend is all toward the external heat sources under low pressure and positive draft. Its advantages are many. A definite temperature, a definite humidity, and controlled rate of air circulation are made possible in such an oven, giving economy of fuel ratio,

Fig. 7—Types of film structure: A—Cereal bond, high permeability, low heat resistance, low strenth. B—Oil bond, medium permeability, strong flexible bond, good heat resistance. C—Taut drying oil bond, rigid, high strength, low flexibility. D—Crinkly drying oil bond, high strength, high flexibility



economy of oil ratio, uniformity and rapidity of drying, and freedom from burning of cores in localized portions of the oven.

The properties of core mixes fall into three distinct categories: The green or mulling and handling properties, the drying properties, and mold properties. Among the first considerations in core mixes is the manner and order of mixing the materials. Where straight oil and sand mixtures are made, there is little difference in the behavior of sands which are different structurally or in size, and little is gained by using intensive mixing. In the author's opinion the most economical order of procedure is to add the proper amount of water to the sand before the oil is added. This promotes more rapid and uniform distribution of the oil, as, due to the difference in surface tension between oil and water, the oil spreads much more rapidly on the moistened grain than it does on the dry grain.

Intensive Mixing Is Essential

When cereals are introduced along with oil and sand in the mix, intensive mixing is essential and the order of adding materials should be sand, then cereal, then water, and last, oil. A short period of dry mixing should intervene before the water addition and another slight interval to allow the wetting of sand and cereal before the oil is added. In a mixture of this type, the grain shape and distribution determines the ease and effectiveness of mixing to a large extent. Rounded grains do not develop strength as rapidly as angular grains nor do they adhere as readily to the cereal.

While there is some variation in the best moisture content, a straight oil and sand mixture in general gives best results at between 4 and 5 per cent moisture. Mixtures containing cereal require a higher moisture content, proportionate to the amount of cereal used.

One of the most important properties of a green core sand mixture is its strength. This is measured in pounds per square inch required to break a standard 2-inch diameter, 2-inch high rammed specimen and varies from a little over 1/10 pound to 1.5 pounds per square inch; straight sand mixtures with core sand and oil giving the lowest values, and high cereal mixtures containing bank sand giving the highest.

The green strength of a straight sand and oil mixture increases with increase in fineness and with angularity of the sand grains. Increasing the width of distribution of the sand grains over the various screens increases green strength materially, and green strength also is increased by increasing the viscosity of the oil used at the expense of developing stickiness to core boxes or patterns.

In cereal containing mixtures, the green strength increases sharply with increase in cereal content and with intensity and time of mixing, in addition to the factors previously enumerated.

Another important property associated with green sand strength in core mixtures is the rate of green strength development on standing of the cores. Oil sand mixtures do not increase perceptibly in strength on standing, at room temperatures but rather tend to lose due to evaporation of moisture, and possibly develop uneven strength at top and bottom of the core due to partial drainage of oil to the bottom of the core. Cereal containing mixtures, on the other hand, after they are rammed up, rapidly air dry at the surface, developing appreciably higher strengths in a short time so that in certain extruding mixtures it is possible, due to frictional heat and drying developed during extrusion, to handle these cores roughly without dryers immediately on extrusion. Similarly, at the end of half an hour, or even less, it is often possible to handle a cereal mix core of complicated design without a dryer. This is a distinctive and beneficial property of such mixes.

The permeability of core mixtures is measured easily in the green state, and this figure generally is equal to approximately 80 per cent of the ultimate permeability of the core after baking. The permeability of a core mix is governed by grain size, shape, and distribution, the amount and kind of binder used, and the moisture content. In general, the permeability of core mixes is higher than that of molding sand for the same size castings; and the permeability of the core should decrease with increased green strength.

The drying properties of core mixes are the measure of the behavior and effects of baking cores in an oven. These properties may be listed as baking characteristics, film formation, distortion, residual film value, and ultimate strength.

Oxygen Needed for Baking

The process of baking a drying or semidrying oil is essentially the oxidation and polymerization of that oil at a temperature suitable for these reactions in the presence of some free oxygen. It is an experimental fact that no amount of heating without the presence of oxygen will make a core harden. The actual amount of oxygen necessary to complete this reaction is approximately 5.7 per cent of the oil content of a core, and normally this oxygen is supplied from the unburned portion of flue gases in a core oven combustion chamber.

Core baking is a combination of several processes occurring simultaneously in different portions of the core. The surface of the core dries rapidly, the core body retaining a temperature of approximately 212 degrees Fahr. until all drying is completed. At this stage the atmosphere of the oven is high in moisture and this moisture partially retards the surface drying rate, tending to keep a balance in drying between the center and outside of a core. Cores of low permeability are more subject to this uneven drying, which often results in weakened and cracked cores, when the difference between the center and outside is too great.

When surface drying is complete, the temperature of the surface rises gradually and distillation of the volatile portions of the core oil occurs. During this period little oxidation of the oil can take place due to the practically complete consumption of the available oxygen in the core oven by these volatile and highly reducing fumes. When this smoky stage of core baking is past, the temperature of the core rises to the oven temperature and true *baking* occurs.

Ultimate strength of a core is dependent totally on strength and elasticity of the (*Please turn to page* 84)

Handles Material Efficiently

By FRANCIS A. WESTBROOK

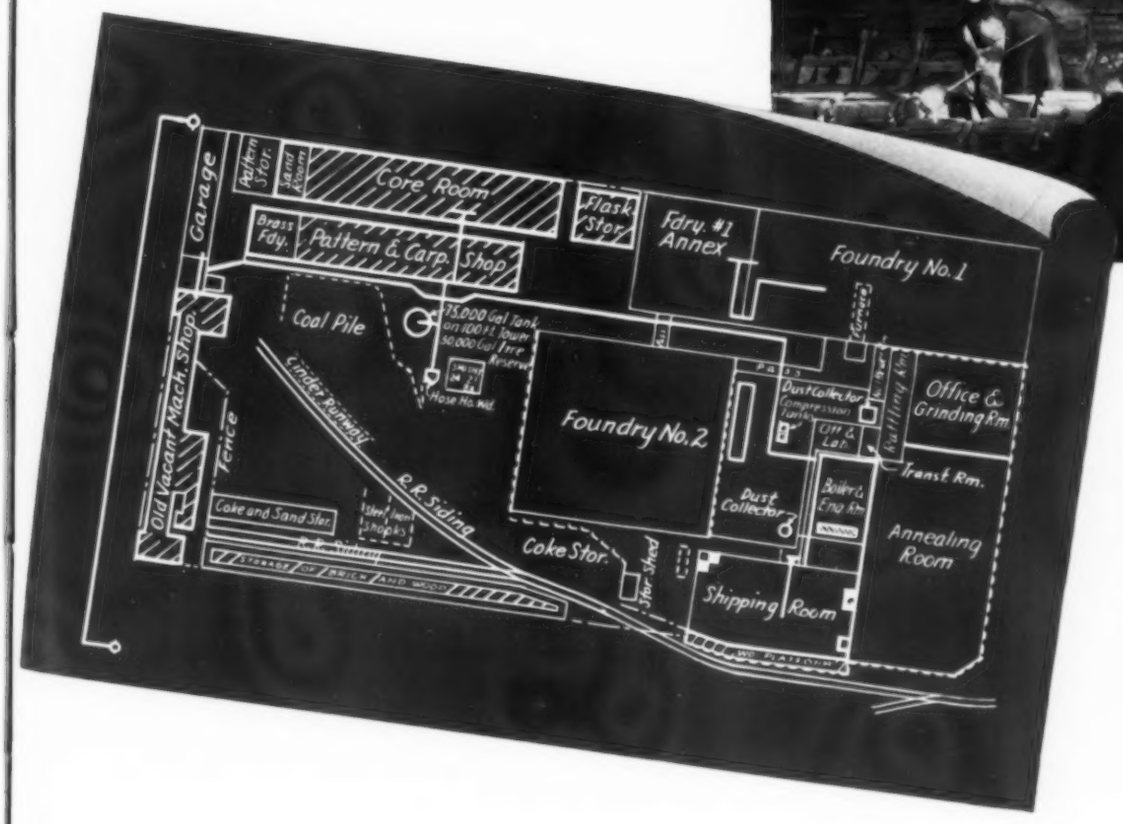


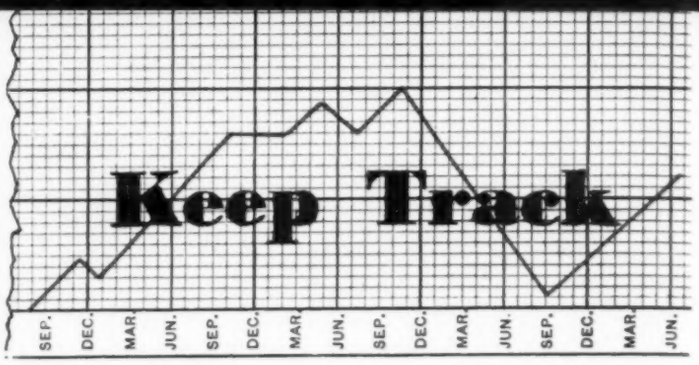
Fig. 1 (Above)—Interior view of foundry No. 1 showing the furnace in the background and monorail serving the heavy castings floor at the right. Fig. 2 (Left)—Beginning at the upper left, incoming material flows through the plant to emerge as finished products at the lower right

THE Rhode Island Malleable Iron Works, Hillsgrove, R. I., was started in 1867 and has kept abreast of the times by adopting modern equipment and handling methods as they became available. The result has been that operations always have been maintained on an economical and efficient basis. The trained personnel and key men in most cases have been with the company for many years.

The company was organized by three business men who were not foundrymen. With only a few malleable foundries in existence at that time these men ventured into the field because they saw good prospects for the future. New England, always a manufacturing center, developed many malleable casting users, and this plant consequently supplied castings for many industries in this region. The company always has employed a competent technical staff.

The only malleable foundry in Rhode Island caters especially to the jobbing trade, making miscellaneous castings, but specializing in those of medium and light weight. To provide a regular line of production, a backlog to stabilize business and employment, a subsidiary company was formed in 1912 for the production of finished malleable pipe fittings. This line, started with malleable pipe unions, has expanded steadily until now the pipe fittings constitute a large part of the output.

Layout of the plant as a whole is shown in Fig. 2. Raw materials arrive on the railroad siding. Pig iron and coal are unloaded in the yard from one branch of the siding. Another siding, flanked by sheds, takes care of the storage of molding, core and sandblast sand, fire brick, clay, lumber, etc. Up-to-date handling equipment is important in the economical operation of the plant. Coal and like materials are unloaded by a clamshell bucket on a caterpillar gasoline crane. Truck-tractors with dump bodies (*Please turn to page* 86)



RECORD OF IRON CONSUMED

CAR NO.	WGT.	COST PER TON				USED	
		INVOICE	FRG'T	UNL'G	TOTAL	WGT	DAY
B&O 189934	60000				$638.35		
Si. Su Phos Mn	VENDOR	$550.00	78.00	$10.35			
.40 .08 .18 .20	RICHARDS BROWN						
					40,000	20,000	3-17-36
					10,000	30,000	3-18-36

RECORD OF COKE CONSUMED

CAR NO.				WGT.	COST PER TON			CONSUMED	BALANCE
PENN 90684				56,840	INVOICE	FREIGHT	UNL'G		
C	A	Su	Vm	VENDOR	$36.94	28.40	$5.68		
							TOTAL COST		
95	10	.04	100	Sem Sol			$71.02		
DATE REC'D.				REMARKS					56,840
DATE USED								2500	54,340
								3000	51,340

IRON MIXTURE

WGT CHARGE _____ DATE _____

WGT. BED CHARGE _____ NO. OF CHARGES

SCRAP ON CHARGE _____

CAR NO.	AMOUNT IN CHARGE	TOTAL WEIGHT CHARGE

Fig. 1 (Top)—Perpetual inventory record card for pig iron shows all the necessary information relating to each car of pig iron purchased including original weight, analysis, cost, and amount consumed daily. Fig. 2 (Center)—A card containing similar data is used to maintain a complete record of the coke purchased and consumed. Fig. 3 (Bottom)—The iron mixture card is prepared by the metallurgist for each day's run to yield iron of the desired analysis

FOR many years the foundry was one of the most difficult industries in which to install or apply a real cost system or control. This difficulty has been overcome in recent years by much study and observation. Industrial engineers and cost accountants have compiled and published rules and systems applicable to any foundry regardless of intricacy of production.

Foundries operating on an average price per pound base, rapidly are passing. The day of the good guessing superintendent who could look at a pattern or drawing and appear to be able to quote a selling price, is gone. The guessing executives have been educated and made cost conscious, or have made too many bad guesses and been eliminated from the field, or have become bankrupt.

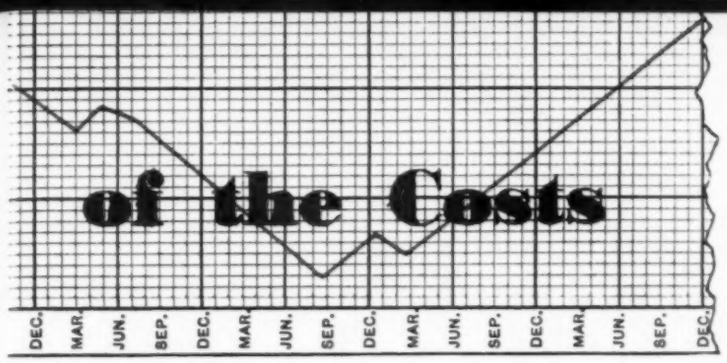
Accurate Information Is Dependable

Accurate cost information is the only dependable method to use in arriving at a fair selling price. Any foundry which makes a variety of castings, part of them at a profit, the remainder at a loss, continually undermines its financial structure. Such practice is unfair competition and causes much strife and discontent among others engaged in the industry. The object of industry is to show a profit on effort. The foundry is no exception. It cannot exist by trading dollars. The customer's dollar is of no more value than that of the foundryman. All iron foundries have a basic cost starting with pig iron at the cupola. There are no secret processes by which competitors gain a price advantage over each other.

Costs properly and systematically compiled and controlled reflect an orderly well managed business. One that the customers feel is capable of producing a quality product.

Reading a recent survey of a foundry the writer noted a paragraph: "The price of our castings is high because we use nothing but pig iron in our mixture." Under normal conditions the basic cost of pig iron is nearly twice that of scrap, but an all pig iron charge does not make a better casting than half pig iron and half scrap.

An accurate cost system in the foundry is a valuable piece of equipment and a most important investment. Foundries today purchase and install new machines, not always because the old equipment has outlived its usefulness, but because modern production demands faster



By H. W. KELLY

machines to meet the ever increasing demand for more production and lower costs.

With a cost system, new methods for arriving at costs are being developed daily. Vendors introduce new methods of manufacture and furnish publications to guide in the use and application of these methods. Although a variety of cost systems are in use, their basic principle is ordinary arithmetic. Certain general methods are common in making castings. All foundries must have molds whether permanent or sand construction. There are no great secrets in the industry. Methods of molding and melting are common knowledge, free to all. A competitor has no particular advantage over his neighbor, unless it may be in skilled workmanship.

Start at Receiving End

In compiling a cost system in the foundry the logical point at which to start is at the receiving end of the raw materials, coke, pig iron, scrap, brick, clay, sand, limestone, etc. In other words at the raw material yard. This includes detailed freight and unloading charges, accurate count and weight of all raw materials. All materials received must be entered on a perpetual inventory card, that will show daily amounts consumed and these deductions shown as a perpetual inventory. Fig. 1 shows a card for the inventory and consumption of pig iron. Fig. 2 is a similar card for keeping record of the coke.

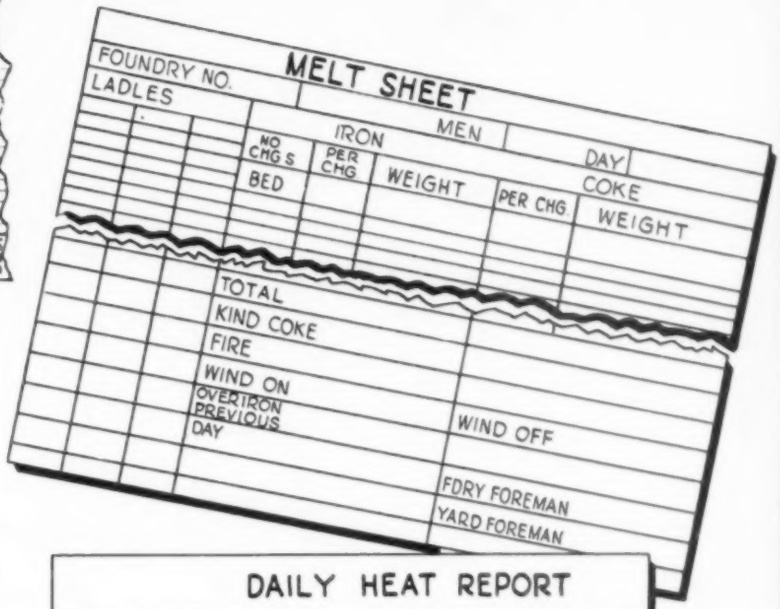
Operations are governed by the class of molding, floor, bench, squeezer, drop machine, stripper and rollover. Production records should show molding price, production required, cleaning and grinding requirements, etc. Power and light should be charged to the department in which they are consumed. Heat is another expensive item to be properly allocated to each department. Each phase of operation should be recorded accurately in order and charged to its respective department for the compilation of proper costs.

Plant orderliness is most important and is a great factor in peak production and a quality product. No expense should be spared in maintaining a clean, methodical plant where men like to work.

All cards and records designed for collecting information covering the expense of operation, purchases and disbursements should be of such a pattern that they are readily adjustable to the general accounting books.

The first step in any business is the purchase of raw material. These disbursements usually are recorded on a formal purchase order and are governed by the perpetual inventory and made only when the stock on hand is approaching a minimum. Next in order comes the stock record of materials on hand showing a daily inventory of all commodities, coke, iron, brick, fire clay, sand, etc.

In a perpetual inventory (*Please turn to page* 89)



DAILY HEAT REPORT

DATE

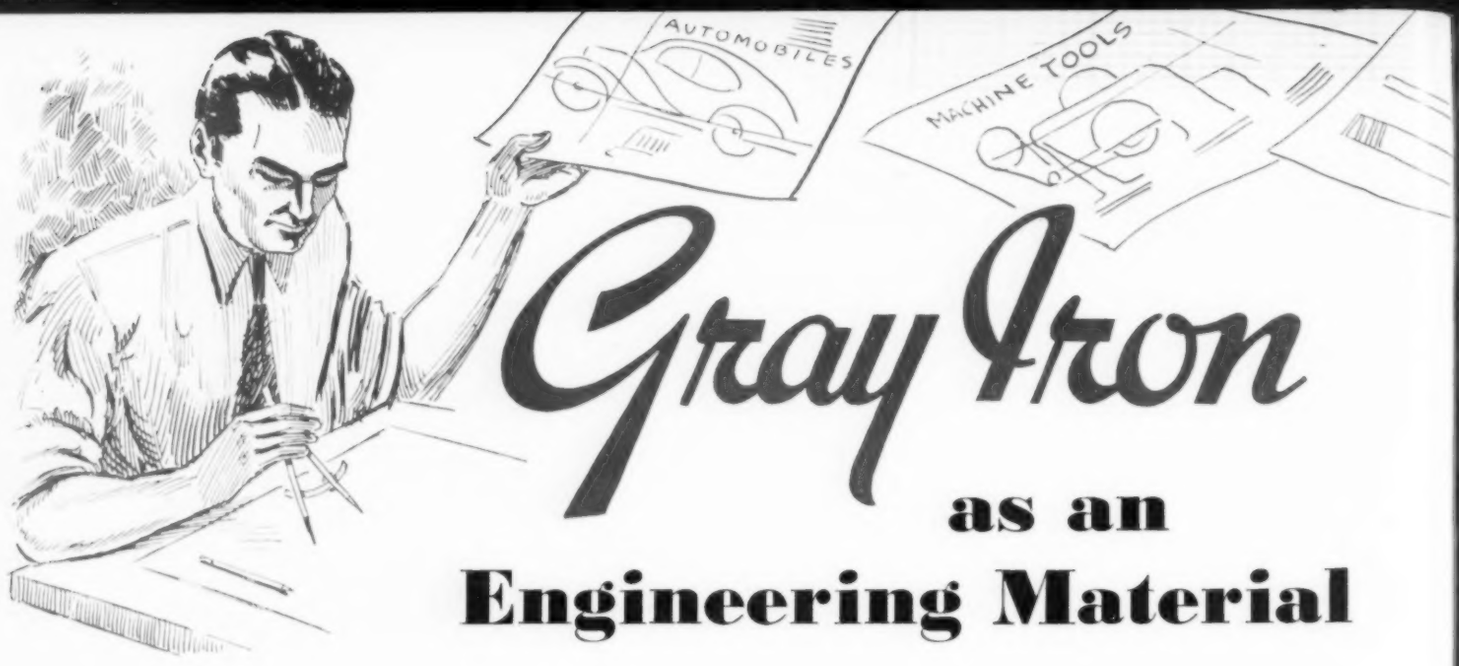
	POUNDS	POUNDS
METAL CHARGED		
PIG IRON		
FOREIGN SCRAP		
HOME SCRAP		
TOTAL METAL CHARGED		
MINUS SCRAP RETURNED		
WEIGHT TO ACCOUNT FOR		
TOTAL WEIGHT GOOD CASTINGS		
WEIGHT GATES & SPRUE		
MELTING LOSS		
COKE USED		
COKE PER TON METAL		
WIND ON WIND OFF		
TON PER HOUR		

DAILY MELT REPORT

DAY — CONDITION OF IRON — DATE 193

CUPOLA NO.	NET TONS	NO. MOLDERS	LBS PER MOLDER	BLAST ON	BLAST OFF	LBS. COKE PER TON	% SCRAP
1							
2							
3							
4							
TOTAL							

Fig. 4 (Top)—Complete history of the day's heat. Fig. 5 (Center)—Complete record of the daily heat for the superintendent or manager. Fig. 6 (Bottom)—Data shown gives the president of the firm a clear picture of molder production



Gray Iron as an Engineering Material

This article is abstracted from a paper presented at the fifth annual foundry conference held at Lansing, Mich., under sponsorship of Michigan State college, A.F.A. and the Detroit Chapter

By GARNET P. PHILLIPS
International Harvester Co., Chicago

SOME of the properties of gray iron which have led to its increasing use by all branches of engineering, either directly or indirectly, are wear resistance, resistance to heat and to atmospheric and other types of corrosion, vibration dampening capacity, wide range of physical properties, ease of casting into almost any design, excellent machinability and relatively low production cost.

In addition other properties, such as resistance to high heat, abrasion and corrosion, are obtained in alloyed irons, some of which are gray and others white. In the latter case the base irons used are, in many instances, gray irons and, in other cases, the very low carbon base irons used are produced by gray iron foundries. Irons of suitable compositions along with suitable casting designs may be hardened by heat treatment for increased wear resistance.

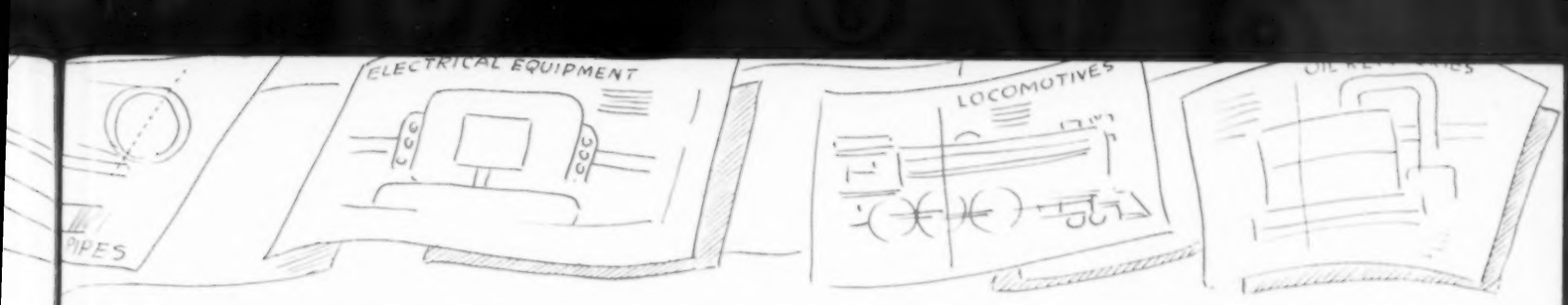
The wear resistance of cast iron is proverbial and is one of the principal reasons for its widespread use in various engineering applications. In modern machines of all types advantage is taken of that property to resist wear of various kinds both against iron and other metals. In general, wear resistance of cast iron increases as hardness is increased. In the automotive, machine tool, railway and various other fields, cast irons are used with hardness ranging from about 170 to 300 brinell in the as cast or normalized condition and with hardness ranging to about 550 brinell in the hardened (quenched and drawn) condition. Outstanding examples of the ever improving wear resistance of cast irons, due to metallurgical improvements, are automotive engine cylinder blocks, liners and sleeves. In early engines, extremely soft and often unsound cylinder bores were obtained with high carbon, high phosphorus gray irons used. Service life, before reconditioning was necessary, was short as measured by present day service results. Today auto engines are expected to render many thousands of miles of service with no undue wear resulting. All increased service life obtained is not due to improvement of quality of iron alone, but also to better lubrication and cooling systems and the fact that cast iron has kept pace with these engine improvements.

Improved wear resistance of cast irons has been obtained by better control of the carbon content, both combined and graphitic, and by use of alloys such as nickel, chromium, molybdenum, vanadium, copper, etc., alone or in various combinations. Better carbon control implies improved control of all phases of metal mixing and melting. The structure of cast irons used for wear resistance consists usually of a predominantly pearlitic matrix containing graphite flakes. The matrix may contain some free ferrite or cementite, or both. Relative value of the matrix and graphite particles in promoting resistance to wear is not fully understood nor evaluated. Both are of primary importance. Effect of size and distribution of graphite particles is not completely understood. Voids left by dislodged graphite particles in a surface subjected to wear are thought to be of value in retaining a lubricant. Increased wear resistance obtained by progressive hardening of the matrix by increasing the combined carbon, by alloying and by hardening through quenching is well known for many types of wear.

White Cast Irons Used

For various types of abrasive wear white cast irons are employed in most cases. Brief mention of these is made here since they are produced by foundries whose principal product is gray iron. White irons produced may range in brinell hardness from about 350 to 450 in plain white irons to over 700 in alloy white irons, the latter having structures consisting largely of martensite and cementite.

Since gray irons, alloy gray irons and plain and alloyed white irons offer such a wide variety and range of



hardness and structure, it readily is understood why wear resistance of metals is one of the primary reasons for widespread engineering applications. Bearing in mind the use of nitrided aluminum bearing alloy gray irons, the hardness range available runs from about 120 to 800 brinell.

An example of improvement in wear resistance is furnished in modern automotive cylinder barrels and liners. Some credit should be given to improved lubrication. Oil filters and oil cleaners are recommended. While definite knowledge is not available on the effect of either graphite or grain size on wear prevention, it may be assumed that graphite in some way is effective with the matrix of the iron in improving wear resistance.

Temperature Affects the Growth

Unalloyed gray irons are in common use at temperatures up to from 700 to 900 degrees Fahr. High silicon, high carbon, coarse grained irons may be used up to about 700 degrees Fahr. with practically no growth occurring. The lower carbon, fine grained irons may be used up to the higher range with safety. At higher temperatures growth will occur due to graphitization of the cementite of the pearlite and also to corrosion of the metal. Products of corrosion occupy a greater volume than the original metal and the same is true of the ferrite and graphite resulting from dissociation of cementite of the pearlite. At temperatures ranging from about 1325 degrees Fahr. upward, where transformations occur in plain irons, volume changes are marked and stresses due to differences in temperature in a casting with resulting differences in rates of expansion and contraction, may cause failure.

For the higher temperature service alloys are used profitably to stabilize the metal, i.e., make it more resistant to dissociation and with higher alloy contents to lower the critical transformation ranges to extremely low values.

Chromium and vanadium are alloys used for increasing carbide stability either alone or in combination with other alloying elements to obtain other desired physical properties. Plain and alloyed gray irons are being applied in heat resisting service at temperatures ranging up to 1500 degrees Fahr. while highly alloyed white irons are used regularly at temperatures ranging up to 1900 degrees Fahr. Table I gives compositions of typical irons used for various temperature ranges. Irons 1 through 5 are gray irons while 6 is a white iron. Iron 5 is an austenitic iron called ni-resist.

Cast iron pipe has been used for many years for underground corrosion resisting service. This service includes water transportation, sewage disposal, drainage and more recently transportation of gas and oil and in the chemical industries.

Cast iron has been used for years for handling caustic and various alkaline solutions under definite conditions. It is used also for handling hot, concentrated, sulphuric acid of over 60 degrees Baume. Special high silicon cast iron and the high chromium cast irons (15 to 32 per cent chromium) are used for handling nitric acid.

Alloy Iron Resist Corrosion

Alloy cast irons are used extensively for various types of corrosion resisting service. High silicon irons with from 15 to 17 per cent silicon are used successfully to withstand corrosive action of most acids except hydrofluoric. These high silicon irons are hard, brittle and not machinable. They are widely used in the chemical industries.

Copper is used to increase corrosion resistance of cast iron to dilute acids, in oil refinery pipe lines and to atmospheric corrosion. Chromium increases the corrosion resistance of cast irons to many types of media. It is used in amounts less than 1 per cent in gray irons up to 34 per cent in special white irons.

Nickel in amounts between 1 and 3.5 per cent increases corrosion resistance of iron to caustic solutions. Nickel is used in conjunction with chrome in a variety of applications. The austenitic (*Please turn to page* 98)

Table I

Typical Irons for Heat Resisting Service

	1	2	3	4	5	6
Max. Temperature Degrees Fahr.	700	900	1050	1300	1500	1900
Per Cent						
Silicon	2.25	2.00	2.00	1.80	1.75	2.00
Carbon	3.60	3.20	3.20	3.20	3.00	2.00
Sulphur	0.10	0.10	0.10	0.10	0.10	0.10
Phosphorus	0.30	0.20	0.20	0.20	0.20	0.15
Manganese	0.60	0.65	0.65	0.65	0.65	0.60
Nickel	....	0.35	1.25	2.00	13.00	....
Chromium	....	0.35	0.65	1.20	2.50	32.00
Molybdenum	....	0.50	....	....	....	....
Copper	....	....	....	....	6.00	....

Table II

Properties After Various Heat Treatments

Condition	Tensile Lbs./Sq. In.	Hardness Rockwell	Hardness Brinell
As cast	44,500	"C" 23	239
Annealed 1550 degrees Fahr.	41,440	"C" 10 "B" 91	187
Oil quenched 1575 deg. Fahr.	25,750	"C" 53	530
Drawn 300 degrees Fahr.	35,000	"C" 52	520
Drawn 400 degrees Fahr.	41,610	"C" 50	500
Drawn 500 degrees Fahr.	54,075	"C" 48	480
Drawn 600 degrees Fahr.	54,940	"C" 48	480
Drawn 900 degrees Fahr.	57,110	"C" 40	394
Drawn 1200 degrees Fahr.	55,550	"C" 31	298
Drawn 1500 degrees Fahr.	38,675	"C" 12 "B" 92	192

QUESTIONS and ANSWERS

This department includes problems relating to metallurgical, melting and molding practice encountered in making castings. Questions from subscribers addressed to the Editor of The Foundry will be answered by members of the editorial staff, supplemented where occasion requires by the advisory staff.

Additions of Copper to Iron Should Be Made in Ladle

We are interested in alloying cast iron with copper by melting in a cupola, and would appreciate receiving information relative to that operation.

So far as we know, copper cannot be added in the cupola successfully due to its low melting point. Consequently, it melts more rapidly than the other materials causing difficulty in that a uniform addition cannot be maintained. The usual method of addition is in the spout or ladle, and between 1.25 and 1.50 per cent can be added if the molten iron in the spout is good and hot. The copper may be virgin or scrap metal, and it should be pure. The copper for additions, should be cut up into small pieces so that it may be dissolved without difficulty. It also is advisable to stir the metal well before pouring.

Desires Yellow Brass Analyses For Easy Machining

Can you give us information on suitable compositions for yellow brass ingots which will produce a nice appearing easy machinable metal, and the procedure used in melting, etc.? We are using a No. 100 crucible in a coke fired pit. Is it necessary to do any fluxing or make any additions if using ingots of the proper composition? Is it a good thing to spray molds with molasses water and to use flour? What purpose does this serve?

In requesting information on yellow brass you did not state the purpose for which it is to be used so we will suggest two that undoubtedly will serve your purposes. One is a yellowish red alloy for plumbers' fittings which has a tensile strength ranging from 30,000 to 35,000 pounds per square inch, and an elongation in 2 inches from 35 to 45 per cent. It contains about 71 per cent or not less than 70 per cent copper, 1 to 2 per cent tin, 2 to 4 per cent lead, and 20 per cent minimum of zinc. The other for heavier castings has about the same tensile strength but the elongation is slightly less or from 25 to 35 per cent. That alloy consists of 66 per cent or not less than 64 per cent copper, 1 per cent maximum of tin, 1 to 3 per cent lead, and not less than 30 per cent zinc.

Either of the alloys should be melted as fast and as hot as is possible, and they should be removed from the furnace when the temperature is up to the desired point to permit handling, skimming and pouring. If the ingot is purchased from a reputable metal supply house, we do not believe there will be any need of fluxing. Also with high zinc alloys it is not necessary to use any deoxidizing agent as the zinc performs that duty effectively. The only addition necessary probably would be a little zinc which volatilizes, and probably a 1 per cent addition will be adequate.

We do not believe that it is necessary to spray the molds with molasses unless the sand is on the dry side or if the castings are intricate leaving numerous thin sections of sand which tend to break off. Molasses water is used where the mold face is dried to some extent as in making chandelier or lighting fixtures, by placing it near a stove. In other words the molasses forms a bond for giving dry strength. Flour serves the same purpose, absorbing moisture from the face of the mold. It also serves a purpose if it is necessary to stamp the pattern back as it prevents the sand from sticking to the pattern. Flour also is believed to produce a fine smooth surface on the castings, but if a fine facing sand is used, results just as good may be obtained without flour.

You mention the use of a self skimming crucible for pouring. That is a good idea, provided the pouring ladle is well heated before being placed into use. If that is not done a considerable loss in temperature will be encountered on the first molds that you attempt to pour with the ladle, resulting in defective castings.

As previously mentioned, one of the essential points is to melt the metal fast and hot. See that your flue opening from the furnace is large enough to take the gases off rapidly, and the same thing applies to your stack or chimney. If those features are properly constructed, we believe that you will not have any difficulty in obtaining the necessary rapidity in melting. Further, arrange the molding and melting periods so that sufficient molds are on hand to receive the metal when it has reached the proper pouring temperature, and do not permit the molten metal to stand in the furnace any longer than absolutely necessary. If the metal is permitted to remain in the furnace it tends to absorb gases which cause defective castings.

Makes Nickel Alloy Castings For Milk Separators

We are making castings for milk separators which must be machined and polished to prevent any particles of milk or cream adhering to them. They must be strong since they revolve approximately 18,000 revolutions per minute. One mixture we are using is composed of 65 per cent copper, 20 per cent nickel shot, 5 per cent tin, 4 per cent lead, and 6 per cent zinc. Another mixture contains 16 per cent copper, 15.5 per cent nickel pig, 1.5 per cent tin, 2.25 per cent lead, 10 per cent monel, 4.5 per cent nickel shot, and 1.25 per cent zinc. We use 2 ounces of silicon with 1 ounce of magnesium to act as a quieter otherwise the metal rises out at the top of the sprues and risers. The metal is melted in an indirect arc electric furnace, and on a new lining the charge is 300 pounds which in about 3 weeks is increased to 400 pounds. The mixtures are poured around 2500 degrees, and the loss ranges from ½ to 3 per cent, but we are not quite satisfied with the mixtures used.

The first composition you mention containing 65 per cent copper, 20 per cent nickel, 5 per cent tin, 4 per cent lead, and 6 per cent zinc, is quite similar to the federal specification WWP-541 except that the amounts of tin and lead are interchanged. The second alloy you mention, is a rather peculiar combination in that you are using nickel pig, monel metal and nickel shot, and evidently the copper should be 65 per cent instead of 16 per cent as you have indicated. Figuring the alloy out in actual terms of copper, nickel, etc., the composition shows 71.7 per cent copper, 23.3 per cent nickel, 1.5 per cent tin, 1.25 per cent zinc, and 2.25 per cent lead. We note that you are using silicon and magnesium for deoxidizing and degasifying, but we believe that you will obtain better results if you change to the following procedure.

In from 5 to 7 minutes before pouring, add 0.10 per cent manganese (97 per cent manganese metal) or 5 ounces for a 300 pound charge; about 2 minutes later add 0.05 per cent magnesium metal in stick form, or 2.5 ounces for a 300 pound charge, and then just before pouring add 0.02 per cent phosphorus or 6½ ounces of 15 per cent phosphor-copper. While evidently you find that alloys you mention are suitable for use in milk handling apparatus, we believe that it would be better to use monel metal as it is our understanding that monel metal or pure nickel are the materials generally used in processing milk and other foods.

Height of Bed Above the Tuyeres May Vary

What is the proper height of the coke bed above the tuyeres to secure hot iron at the first tap. Certain authorities claim that 24 inches is sufficient, while others advocate heights ranging from 30 to 54 inches.

Height of the coke bed above the tuyeres cannot be set down as an arbitrary figure that will apply to all cupolas under all conditions. The variable factors which must be taken into consideration include weight of charge, composition, size of individual pieces, volume and pressure of blast, carbon content of coke, elapsed time between lighting and blast on, diameter of cupola, and condition of lining and bottom. More heat is required to melt large pieces of iron, steel, or malleable iron, than is required when the charge is made up of small pieces of gray iron scrap and pig iron.

Manifestly a greater quantity of low carbon coke than high carbon coke would be required to develop the same temperature. Where the charge is allowed to soak for an hour or more before the blast is applied, the first iron will melt hotter and faster than where the blast is applied to a comparatively cold furnace. Even where all other conditions are favorable, a wet or hard bottom will chill the first iron that comes down. In ordinary practice a 30-inch bed above the tuyeres is favored by the majority of foundrymen. This means 30 inches after the bed is burned through and has settled. A slight variation in this height up or down for a few experimental heats will determine the ideal height for the particular conditions prevailing in any foundry. However, in some cases a considerably higher bed will be required.

Wants Information on Castings For Parts of Glass Molds

Since glass manufacturers are speeding up production by operating the molds at higher temperatures, we would like to obtain information on suitable mixtures for glass mold and plunger castings for operation at elevated temperatures.

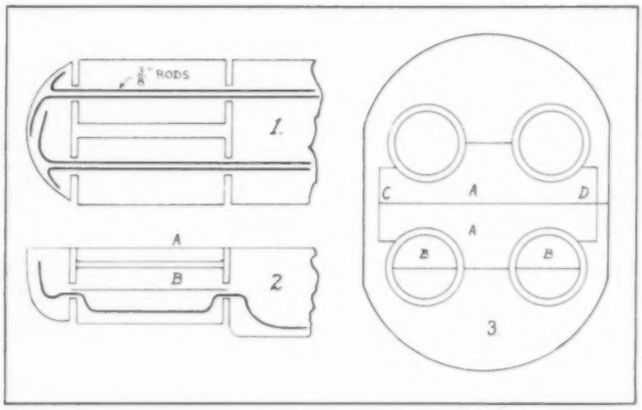
A number of alloy irons are being applied successfully for glass molds and other parts. These include straight nickel, nickel-chromium, nickel-copper-chromium, molybdenum, and chromium-nickel-aluminum-vanadium alloy irons. One contains approximately 1.50 per cent silicon, 0.60 per cent manganese, 1.50 per cent nickel, 0.60 per cent chromium, and 3.30 per cent total carbon. Another contains 1.60 to 2.00 per cent silicon, 1.50 to 2.00 per cent nickel, and 2.80 to 3.00 per cent total carbon.

A third alloy iron includes 14 per cent nickel, 2 per cent chromium and 7 per cent copper in addition to the usual amounts of silicon, etc. found in cast iron. A fourth contains about 3.35 per cent silicon, 0.25 per cent manganese, 2 per cent chromium, 0.75 per cent nickel, 2 per cent aluminum, and 0.25 per cent vanadium.

Core Is Problem in Jacketed Casting

We are enclosing blueprint of a water jacketed boiler casting made in different sizes from 2 to 3 feet in length and from 18 inches to 2 feet in diameter. The casting has to be poured in an upright position and no chaplets are allowed. The inside body is connected to a dome end by four tubes or barrels, but the connection is only 1⅜-inch in diameter at each end of the barrel. The entire inside body then is enclosed in the jacket. We shall appreciate your opinion on the best way to make the cores and whether it is feasible to use part boxes and strickles.

The casting shown on the blueprint presents some very interesting features. In the brief space at our disposal we only can outline a proposed method. If you have many to make you should have full coreboxes. For a few castings you can get along with skeleton and strickles. The accompanying illustrations cover the main points. They are not drawn to scale and many of the detail features are omitted for clarity. Except for the outline in Fig. 3 the jacket core and the prints for holding the core in place are not shown.



Figs. 1 and 2—Top and side view of one-half of the inside core at barrel or tube and. Fig. 3—Half cores have points which fit in corresponding prints in the jacket core

Figs. 1 and 2 are the top and side view of one-half of the inside core at the barrel or tube end. This core is in two parts and jointed along the center line. Each half is all in one piece, that is the long body, the dome end, and the two half barrels. Two ⅜-inch rods, bent as shown, extend from the dome, through the barrels and into the main body of the core. A separate half core *B* is pasted in place to form the complete barrel and this in turn is covered by the core *A* in Figs. 1 and 3. A similar core A^1 in Fig. 3 is placed in the other half of the core. The half cores *A* and A^1 are provided with prints *C* and *D* which fit snugly in corresponding prints in the jacket core. This arrangements will simplify setting the cores in the mold.

The inside core, top and bottom halves with the cores *A* and A^1 can be assembled, pasted and wired and placed in the lower jacket core in one piece. Thus the lower half of the jacket core is lowered into place first where it will be supported by the side prints near each end. The inside compound core then is placed and then the upper half of the jacket core is placed in position. In fact the entire core, inside and outside, may be assembled in the core room, or on the core car and then picked up as a unit and lowered into the mold.

Metal Losses Will Be Different

Would you kindly advise us if you can furnish us with a comparison of metal losses on yellow brass ingots and also on heavy brass scrap. We melt with oil furnaces and would like to know what per cent loss per hundred pounds we should expect on each.

The melting loss on yellow brass ingots will vary widely with the temperature at which they are poured. To pour light work, the metal must be superheated and the zinc is driven off resulting in a high melting loss. If the castings are relatively heavy and may be poured at moderate temperature, the melting loss should not exceed 2 to 3 per cent when using ingots and melting in a crucible. You do not state whether you are melting this metal in a crucible or on a hearth where the flames directly strike the metal and, consequently increase the surface temperature of the pieces so heated. We presume, however, that you are using a crucible heated by an oil flame and our remarks are based on that assumption. If the yellow brass is finely divided as in borings, or very small pieces of gates and risers, the loss will be increased since you have a much larger surface exposed for superheating during the melting.

You speak of the loss in using heavy brass scrap. We assume that this heavy brass scrap is also yellow brass, and would point out that if the pieces are about the size of ingots or larger, the melting loss will be about the same as for ingots. If you are referring to a red brass, when you speak of heavy brass scrap, obviously the melting loss would differ, since there is no such large proportion of zinc present in red brass and consequently the vaporization or volatilization of zinc does not raise the melting loss so acutely. It is no uncommon thing to have 4 or 6 per cent loss on reasonably sized pieces when charged in a crucible, if medium weight castings are to be poured in yellow brass.

In red brass about 2 per cent is not an excessive loss, although careful melting practice could reduce that easily. Constant diligence in the prevention of spillings and other losses that increase the amount of metal that is lost and charged to melting loss in the normal foundry, must be maintained. In casting the yellow brass that you describe, the work produced will be satisfactory if a small proportion of aluminum is present in the yellow brass. The melting loss will be reduced in consequence of the presence of aluminum. It is well known that a very small percentage of aluminum in yellow brass forms an envelope of aluminum oxides which covers the bath and prevents the oxidation of the metal under the covering, and since this covering is rather tenacious, the melting loss due to vaporization of zinc is reduced. About 1/10 or 2/10 of 1 per cent of aluminum is all that should be permitted. Of course if red brass is melted, aluminum is harmful and should be avoided.

Casting Bronze on Steel Shaft

We are having trouble in casting a bronze sleeve 9 inches in length on a 4-inch steel shaft 30 inches in length. The shaft is heated to a cherry red and placed in a skin dried mold elevated about 2 inches at one end. The metal is poured through three small branch gates at one side of the joint and we run a considerable amount of metal through so that the metal will fuse to the surface of the shaft. Later during the machining process most of the castings disclose blowholes.

Blowholes in castings are caused either by steam or gas, or by a combination of both. If the cause of either or both of these factors is removed, the bronze will lie quietly against the steel. Heating the shaft will remove the first cause, that is a practically imperceptible film of atmospheric moisture. However, in heating the shaft to a cherry red a slight metallic scale or oxide is formed and this is more conducive

to the formation of blowholes than any original moisture.

It is not necessary, in fact it is highly undesirable, to heat the shaft to such a temperature. A temperature of approximately 200 degrees Fahr., "Hot enough to boil a spit" is sufficient. The surface of the shaft exposed to the bronze should be cleaned thoroughly before it is placed in the mold. On production jobs this is done best by some form of pressure blasting appliance. On intermittent jobs the surface may be cleaned by grinding, or by rubbing with sandpaper, emery paper, a file or any other form of hand abrasive.

The object is to provide a surface absolutely free of any trace of moisture or oxide film. An alternative method is to electroplate the exposed surface of the shaft with tin or copper. Position of the gates is immaterial, since no system of gating and pouring can overcome the handicap of an oxide film on the shaft. Where the shaft is perfectly clean, and this practically means hospital cleanliness, the metal should be poured rapidly through generous size gates, and a certain amount should be flowed through risers at each end of a horizontal mold. Elevating the mold at either end is of no practical benefit. The exact amount to flow through easily may be determined after one or two trials.

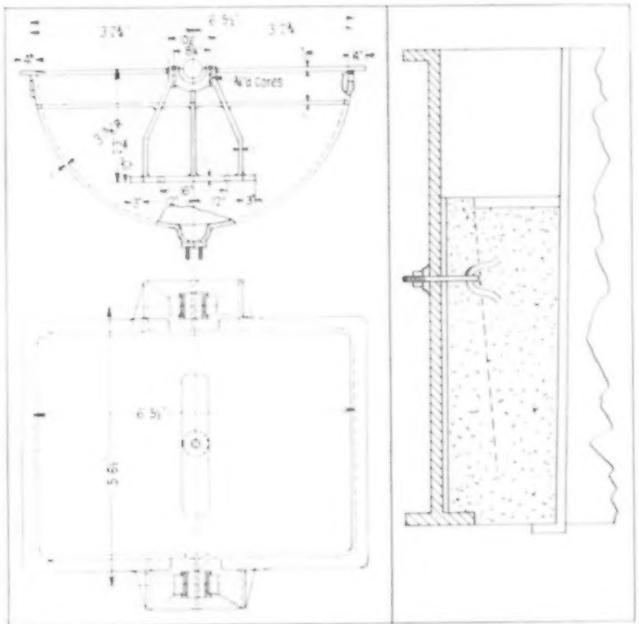


Fig. 1—Plan and end views of castings. Fig. 2—Flange A may be cast or bolted to flask

Brackets Molded in Pair of Cores

We shall appreciate your opinion on the pattern construction and method of molding the casting shown in the accompanying illustration, a flanged half drum with bracketed trunnions at the ends.

Assuming that you have flasks of a suitable size, proper crane service and ample oven capacity, we suggest molding the casting flange down in a dry sand mold and with the brackets on the ends formed in dry sand cores. In one method the cores might be made in advance, laid up in proper position at the ends of the pattern and rammed up with the cope. The cores would rest on a shelf attached to the bottom edge of the cope and would be held in place by bolts through the side of the flask as shown in Fig. 2. The lightening core under the bearing would rest in prints in the larger core.

In a second method a large block print might be attached to the end of the pattern. After the cope is lifted, rolled over and the pattern removed the core is set in place and suspended through suitable hooks extending through the top of the cope. The pattern need not be elaborate, made up of the rectangular flange, the two semicircular ends joined by staves to a point about halfway up on each side and with a central stave on top carrying the trough and nozzle. A mound of coke is placed in the center and after the sand inside the pattern is rammed about halfway up, additional loose staves are set in place, or alternatively this part of the mold could be formed with a straightedge riding on the ends. Preferably the casting should be gated at both sides through a pair of thin gates set about 6 inches above the flange and delivering metal into the end walls.

Sand That Fuses Is Not Suitable

We are troubled with gas holes in many of our castings particularly those in a 30 per cent semi-steel mixture. This form of defect does not appear on straight gray iron castings, nor on light or heavy castings with uniform metal section. Therefore, we have decided the cupola practice is not to blame. We pour the metal hot, since the trouble seems to be accentuated with cold metal. Our sand is not the best. On heavy castings it is not uncommon to find a layer 1 inch thick fused to the casting. Slag also appears on some of the castings, but the least amount appears on castings made in molds that have been either skin dried or dried in the oven. We have tried every method of gating. The metal left in green sand pouring basins and sprues on heavy castings resembles a Swiss cheese. Chunky castings poured in green sand present the same appearance. In one instance recently we poured two piston rings 1¼-inches thick and three flanges 150 pounds each from the same ladle. One flange was poured first, then the rings and then the other two flanges. The piston rings were perfect, but the flanges showed gas holes on machining, some ½-inch deep. Can you suggest a remedy?

From the evidence presented, sand that fuses to the face of the castings and gas holes in sprues and pouring basins as well as in the castings, it would appear that the sand is not fit for molding purpose. The obvious remedy is to throw it all out and secure sand in which the iron will lie quietly. The sand apparently contains too much clay or other easily fusible material. When the metal is poured into the mold it acts in the same manner as when poured into a poorly dried clay lined ladle. This diagnosis is supported by the statement that blackwashed and dried molds are fairly satisfactory. However, the diagnosis is not altogether convincing since *all* castings do not react in the same manner.

A possibility exists that while drying presents a satisfactory face on some molds, it is not quite sufficient on molds where the metal surrounds or nearly surrounds a body of sand. In these instances a greater volume of gas than usual is generated and since it cannot escape readily through the sand, some of it enters the metal and is trapped to appear later as holes in the casting. Since in all probability it is not feasible in your particular instance to change your source of sand supply, you might make a particular study of each casting and *doctor* the facing to provide greater permeability and refractoriness. This can be done by adding a certain amount of coarse sharp sand. In addition the mold can be vented with a wire, and in extreme instances a layer of coke or ashes can be introduced in corners and pockets.

ADVERTISING PAGES REMOVED

MEN of INDUSTRY

H. M. GEORGE, active in the cast iron boiler and radiator field for many years, recently sailed for Paris, France to take up new duties of equipment standardization in the European plants of the American Radiator Co. Mr. George has served the American Radiator Co. in its Kansas City, Birmingham, Ala., and St. Paul. plants, and for the past 6 years

H. M. George

has been located at the Bond Plant, Buffalo, as general superintendent. For the past two months he has been visiting the larger production foundries in this country before assuming his new duties. Mr. George is a member of the American Foundrymen's association and the American Society for Metals.

♦ ♦ ♦

GUSTAV LAUB, general manager of sales, Vanadium Corp. of America, New York, has been appointed assistant vice president and general manager of sales of that company.

♦ ♦ ♦

C. H. BOENIG, Youngstown, N. Y., has been made sales engineer, Harnischfeger Corp., Milwaukee, in the western section of New York, with Rochester as the eastern boundary.

♦ ♦ ♦

E. G. ALLEN, vice president and sales representative, Dayton Oil Co., Dayton, O., in Michigan, Indiana and a portion of Ohio, has changed his headquarters from Cleveland to Coldwater, Mich.

♦ ♦ ♦

ERNEST L. NYE of Freeman & Co., has been elected a director of the American Car & Foundry Co., New York, succeeding G. R. SCANLAND. Mr. Scanland, a vice president, has been inactive in the company's affairs since Jan. 1.

♦ ♦ ♦

R. E. HOWE has been elected president, Appalachian Coals Inc. Cincinnati. Other newly elected officers include A. L. BROWN, vice president; W. M. WILSHIRE, secretary-treasurer, and T. A. DAY, assistant secretary.

♦ ♦ ♦

DR. HARRY A. SCHWARTZ, manager of research, National Malleable & Steel Castings Co., Cleveland, and a member of the editorial advisory staff of THE FOUNDRY, has been appointed professorial lecturer in the metallurgical department of Case School of Applied Science, Cleveland.

♦ ♦ ♦

SYDNEY W. JONES has been appointed purchasing agent, Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y., succeeding the late Adelbert G. Clark. Mr. Jones has been identified with the engineering department of the Shepard Niles corporation since 1919.

♦ ♦ ♦

R. G. DICKENS, formerly chief clutch engineer of the Hilliard Corp., Elmira, N. Y., has been placed in charge of sales and services of clutches for that company in the Chicago district. His office is located at 201 North Wells street.

♦ ♦ ♦

RALPH L. WILSON, former metallurgical engineer, Timken Steel & Tube division of the Timken Roller Bearing Co., Canton, O., has become associated with the Climax-Molybdenum Co., in the capacity of metallurgical engineer in the development field. Mr. Wilson's headquarters will be in Canton. A graduate in 1921 from Lehigh university, Mr. Wilson served on the metallurgical staff of the United Alloy Corp. from 1921 to 1926 and with its successor the Central Alloy Steel Corp. until 1928. He then was appointed assistant metallurgical engineer of the Timken Steel & Tube Co., becoming metallurgical engineer of the same company in 1933.

♦ ♦ ♦

P. C. DAY has been appointed vice president of the Falk Corp., Milwaukee. After being in charge of the West Drayton Gear works,

P. C. Day

Power Plant Co., England, for some years, Mr. Day became associated with the Falk Corp. in 1910 as chief engineer to direct work of pioneering helical and herringbone gearing in the United States. He will remain in charge of engineering with the title vice president, chief engineer.

♦ ♦ ♦

OSCAR F. PATZKE, recently appointed sales manager of the Smith Steel Foundry Co., Milwaukee, has been elected a vice president of that firm, continuing to direct sales. He entered the steel casting industry in 1911 with the old National Steel Foundries Inc. in Milwaukee and before joining the Smith organization was connected with the Milwaukee Steel Foundry Co.

♦ ♦ ♦

E. S. CROSBY, since 1929 vice president and general manager, Johns-Manville International Corp., a sub-

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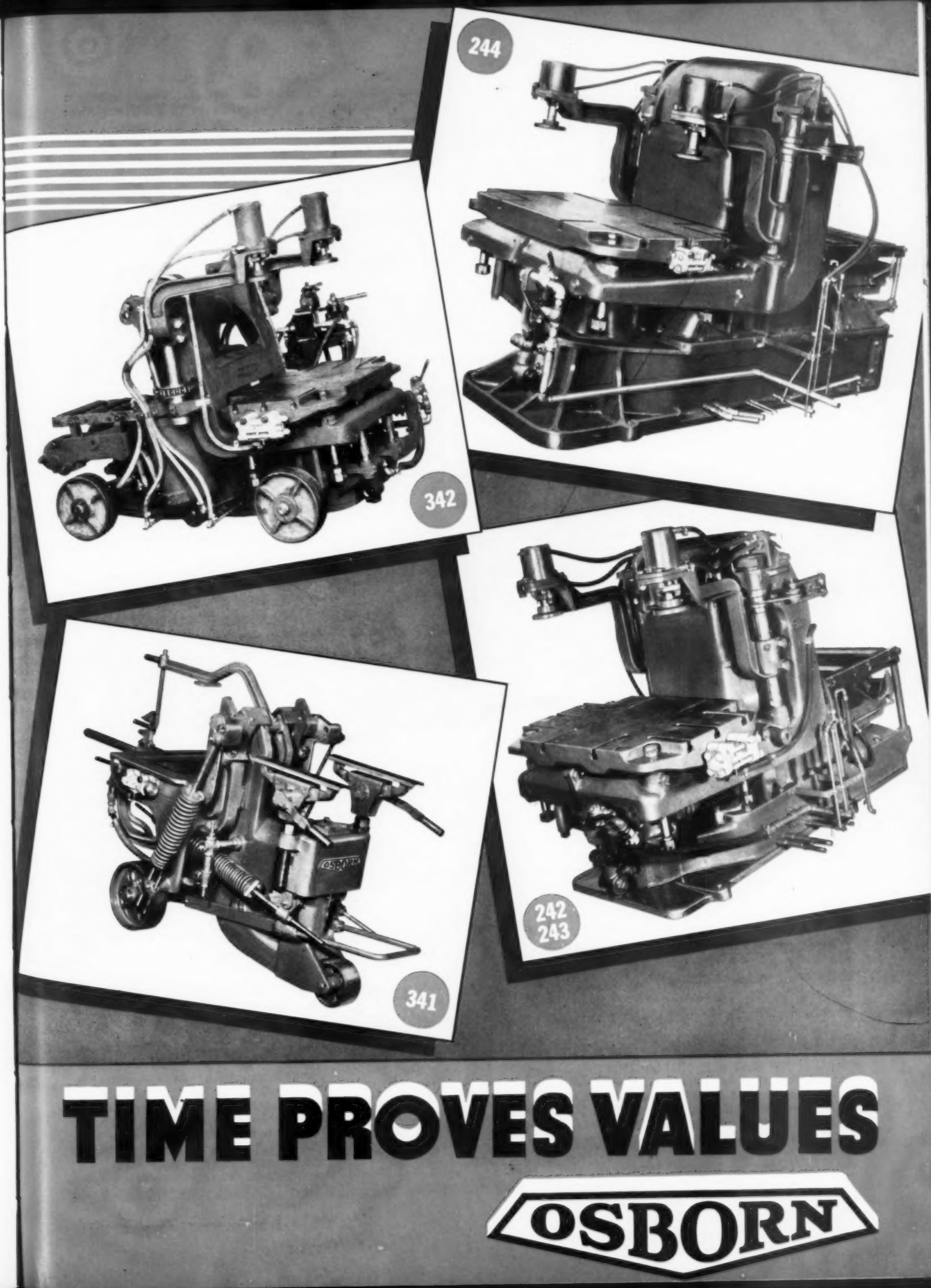
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TIME PROVES VALUES
OSBORN

(Concluded from page 46)

sidiary of Johns-Manville Corp., has been named president. Mr. Crosby joined that organization in 1928 when it absorbed the Celite Co. of which he was a vice president and director. His first position with Johns-Manville was as general manager of the engineering department.

♦ ♦ ♦

C. E. NOBLE, formerly assistant metallurgist, E. C. Atkins Co., Indianapolis, has been placed in charge of the Pittsburgh office of the Pyrometer Service & Supply Corp., Cleveland.

♦ ♦ ♦

JAMES L. MONAGHEN, who became connected with the Filer & Stowell Mfg. Co., Milwaukee, as an office clerk, and who, since 1922 has been president and general manager of the company, celebrated his fiftieth anniversary with that company on July 27.

♦ ♦ ♦

LYMAN C. JUDSON, a graduate of Cornell university, Ithaca, N. Y., and for the past 20 years identified with the electrode business, has been appointed electrode sales manager of the National Carbon Co. Inc., with headquarters at 30 East Forty-second street, New York.

♦ ♦ ♦

VICTOR M. DRURY, president of Drury & Co., recently was named president of the Canadian Car & Foundry Co., Montreal, Que., to succeed the late W. W. Butler. Mr. Drury, in addition to being a director of the Canadian Car & Foundry Co. for a number of years, is chairman of its executive committee.

♦ ♦ ♦

ARTHUR GUNLITE, formerly connected in a sales capacity with the Peterson Core Oil Mfg. Co., Chicago, recently has been appointed general foundry superintendent, Bremen Aluminum & Brass Products Corp., Bremen, Ind. Mr. Gunlite was born in Toledo, O., and was affiliated with the Toledo Stove & Range Co. for 15 years. His experience in the foundry industry extends over 25 years.

♦ ♦ ♦

CHARLES H. KEENEY recently became associated with the Connecticut Blower Co., Hartford, Conn. as general manager and chief engineer. Mr. Keeney has had over 29 years of experience, both technical and practical, in the blower field, specializing in the design, fabrication and installation of dust collecting and ventilating systems. For 18 years prior to 1928 he was connected with the Connecticut Blower Co.

♦ ♦ ♦

W. F. STREMKE recently resigned as assistant secretary of the Sivyer Steel Castings Co., Milwaukee. Mr. Stremke has been connected with the foundry industry for 25 years, spending 10 years in the gray iron branch and being associated with the Sivyer company for the past 15 years, where he was timekeeper, purchasing agent, assistant to the president and assistant secretary respectively.

♦ ♦ ♦

GEORGE E. SIBBETT, vice president and general manager, Pacific States Cast Iron Pipe Co., Ironton, Provo, Utah, a subsidiary of McWane Cast Iron Pipe Co., Birmingham, Ala., recently resigned to go into the iron and steel construction business in San Francisco. Mr. Sibbett had been general manager of the plant since its construction in 1926. At that time he was chief engineer for the Columbia Steel Co., one of the original owners of the plant. Mr. Sibbett supervised the construction of the plant and then became general manager, being made vice president and a director in 1929.

O. H. KING, treasurer of the company for the past several years, will succeed Mr. Sibbett as general manager and also will continue as treasurer.

♦ ♦ ♦

W. CORDES SNYDER JR., formerly vice president of the Lewis Foundry & Machine Co., Pittsburgh, a Blaw-Knox Co. subsidiary, was elected president of that organization at a recent meeting of its board of directors. Mr. Snyder attended Bellefonte academy, Washington, Harrisburg academy and supplemented that by studying mining engineering at Lehigh university in 1923. After completing his studies, Mr. Snyder became connected with the Wheeling Mold & Foundry Co., Wheeling, W. Va., serving a 2-year apprenticeship in charge of the chemical laboratory. In 1927 he became associated with the Lewis Foundry & Machine Co. as a metallurgist and roll maker and in 1936 was made vice president of that company. His election as president fills a vacancy which has existed for the past year.

Whiting Corp., Harvey, Ill., recently awarded service emblems to 279 employes of whom 42 have been employed continuously for over 25 years, 176 for over 10 years and 61 for over 5 years.

Celebrate Completion of Thirty Years' Service

SAMUEL H. JASPER, manager Pittsburgh office of the Penton Publishing Co., Cleveland, publisher THE FOUNDRY, *Steel, Daily Metal Trade, Power Boating, Abrasives, Machine Design, and other business and technical publications, was guest of honor Sept. 29 at a luncheon in Hotel Cleveland, attended by 75 of his business associates. The occasion marked the completion of 30 years continuous service with the company. A gold watch suitably engraved was presented to Mr. Jasper by John A. Penton, chairman of the board of the Penton Publishing Co. In making the presentation, Mr. Penton referred to the high code of ethics governing the business and industrial press and felicitated Mr. Jasper on his unswerving adherence to that code.*

E. L. Shaner, president Penton Publishing Co., presided as chairman and read a sheaf of witty, earnest and congratulatory messages from offices of the company in the United States and in foreign countries. In a similar vein, toasts also were proposed by representatives of the different departments in the home office.

Samuel H. Jasper

Beginning in the stock room September, 1907, as a boy bubbling over with energy and ambition, young Jasper rapidly advanced through the circulation and advertising departments. Through his outstanding work as advertising solicitor he was placed in charge of the Pittsburgh office 25 years ago. In the intervening years he has had remarkable success in his territory and is widely known and respected throughout the iron and steel industry in the Middle West, East and South. He is a member of the Pittsburgh Advertising club and the Pittsburgh Foundrymen's association.

ADVERTISING PAGES REMOVED

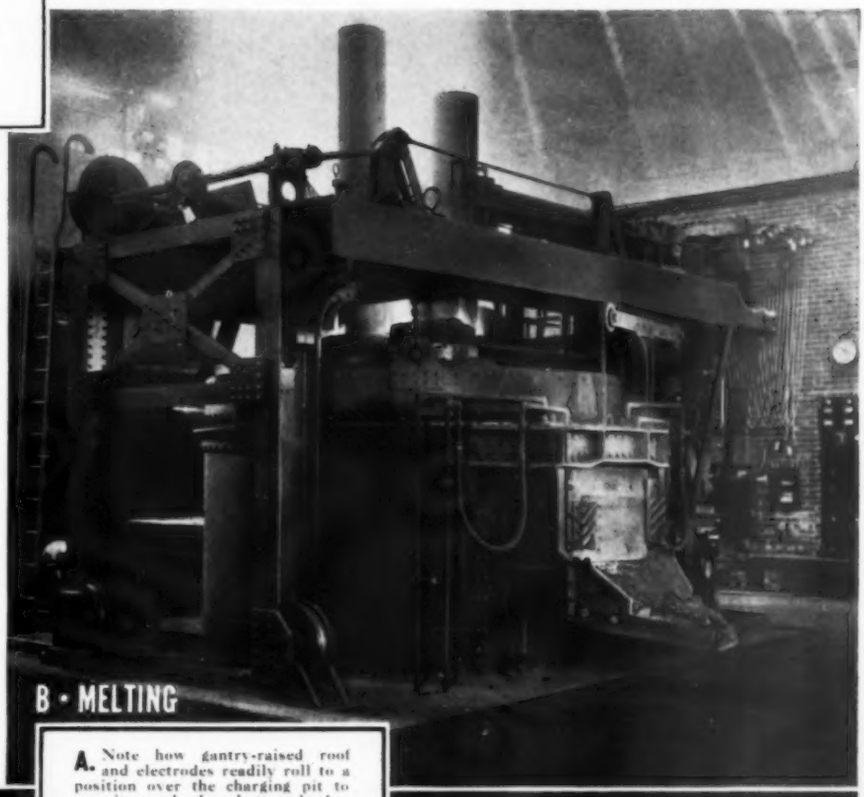
Now..5 NEW MAJOR FEATURES IN Heroult ELECTRIC FURNACES

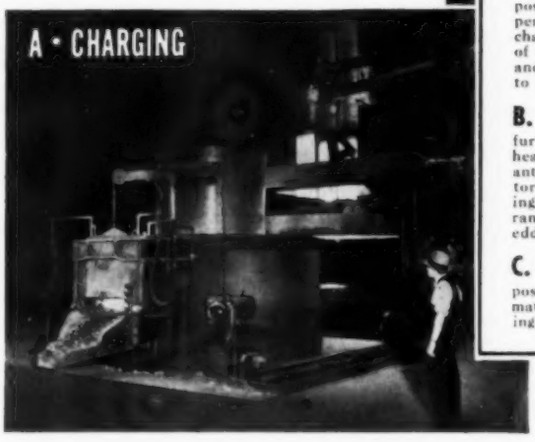
1. Gantry-type removable roof.
2. Lightweight, corrosion-resistant roof coolers.
3. Improved wedge-type electrode holders.
4. Water-cooled, current-carrying copper tubing arranged to prevent hysteresis and eddy current losses.
5. Attached floor, tilting with shell when pouring.

THESE, and other recent innovations, give you an efficient, modern production tool with excellent metallurgical and low-cost operating performance.

Heroult Electric Furnaces have gained a remarkable reputation by efficient melting and refining of ferrous materials — alloy, tool, and stainless steels; iron or steel castings. These improved furnaces are sturdily built with simple, effective tilting mechanisms. Dependent on size and operating requirements, they are adaptable to hand, chute, machine or drop-bottom bucket charging. Capacities range from ½ to 100 tons.

To meet your specific requirements, American Bridge offers complete facilities for design and construction of these unusually efficient, easily operated electric furnaces.





A. Note how gantry-raised roof and electrodes readily roll to a position over the charging pit to permit speedy drop-bottom bucket charging. how four-point support of the raised roof eliminates warp and consequently reduces damage to refractories.

B. Here is the improved furnace in action with gantry frame over furnace and roof lowered for the heat. Lightweight, corrosion-resistant roof coolers save roof refractories; water-cooled, current-carrying, copper tubing is uniquely arranged to prevent hysteresis and eddy current losses.

C. As if one unit, furnace, floor, gantry, and roof, still in melting position, tilt together in an automatic, electrically controlled pouring action.

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UNITED STATES STEEL

Connecticut

CONNECTICUT Nonferrous Foundrymen's association met on Tuesday evening, Sept. 21 at the New Haven Yacht club, New Haven, Conn. A. D. Eplett, metallurgical engineer, Consolidated Ashcroft Hancock Co., Bridgeport, spoke on "Heat Treating of Bronze Pressure Castings", and pointed to the progress which has been made in the heat treating of nonferrous castings. Considerable discussion followed the formal presentation. T. Joseph Judge, Jenkins Bros. Co. presided at the meeting.

The next meeting of the association will be held Oct. 19 and will be devoted to a round table discussion on problems of nonferrous practice.

Quad City

THE first meeting of the 1937-38 season of the Quad-City Chapter of the American Foundrymen's association, was held Sept. 20 at the LeClaire hotel, Moline, Ill. About 75 were present with visitors from Waterloo, Iowa, St. Louis, Joliet, Ill., Chicago and other cities. P. T. Bancroft, chairman of the chapter, presided.

Reports of the various committees were presented. R. L. Eichman reported that progress is being made by the membership committee. T. J. Frank announced the program being arranged for the second Iowa foundry conference at Iowa City, Oct. 29 and 30 and urged a good attendance. J. L. Desparois, Pickands Mather & Co., St. Louis, extended an invitation to the foundry conference to be held at Rolla, Mo. A. W. Gregg, Whiting Corp., Harvey, Ill., invited the Quad-City members to the annual outing and regular meeting of the Chicago chapter of the A. F. A.

M. J. Gregory, Caterpillar Tractor Co., Peoria, Ill., presented an interesting talk on "Alloys and Their Applications to the Foundry." Mr. Gregory discussed the changes which have been made in the cast iron field due to the use of alloys and outlined what may be done with various alloys in providing castings to meet a wide variety of needs. He stated that temperature control was an important consideration in the heat treatment of alloy cast iron.

Following the formal presentation, Mr. Gregory answered many questions on the practical phases of foundry operations.

The next meeting of the chapter will be held at the Fort Armstrong hotel, Rock Island, Ill., on Oct. 18.

Northern California

NORTHERN California chapter of the American Foundrymen's association met at the Whitcomb hotel, San Francisco, Sept. 10. Charles Hoehn, chairman of the chapter, reported on his recent visit at two meetings of the Lower San Joaquin valley foundrymen held at Bakersfield and Fresno. He also presented a block and gavel, symbolic of the molding trade, which was made of lignum vitae and marked with a copper plate "Southern California Chapter, American Foundrymen's Association. Organized April 21, 1937. Compliments of Northern California Chapter." This gavel is to be presented to the Southern California chapter through its chairman, Robert Gregg.

Dr. J. P. Russell, California State Health department, presented the principal talk on "Control of Occupational Diseases." Dr. Russell pointed out that periodic physical examinations often reveal the beginnings of occupational disease before the affected person has any idea that he is not in the best of health, and paves the way for corrective measures which prevent needless suffering and loss of wages from inability to work. It is proposed to make the industrial hygiene service in California an agency for providing a definite consulting and advisory service, rather than a regulatory or law enforcement agency. Services of the department are available to any industry which wishes information as to health hazards.

Canada

THE first Montreal meeting of the Canadian section, American Foundrymen's association, was held in the Windsor hotel, Montreal, Sept. 15. Harold J. Roast, vice chairman of the Canadian section, acted as chairman of the meeting. Fifty-one were in attendance.

Feature of the meeting was a discussion of foundry problems as presented by slides thrown upon the screen. Mr. Roast led in this discussion.

Communications of congratulations were received from Joseph Sully, chairman of the Canadian section; George B. Frost, general manager, Smith's Falls Malleable Castings Ltd.; D. J. Macdonald, secretary-treasurer of the Canadian section of A. F. A.; and S. R. Francis, Metals & Alloys Ltd.

The chairman thanked the Canadian Steel Foundries and the Dominion Engineering Works Ltd. for supplying several of the slides used in the technical discussion. A buffet luncheon was served following the meeting.

Milwaukee

THE first meeting of the Milwaukee Chapter of the American Foundrymen's association was held at the Schroeder hotel, Milwaukee, Sept. 17, with an attendance of 170. Walter Gerlinger, Walter Gerlinger Inc., chairman of the chapter, presided.

Voyta Wrabetz, chairman of the Wisconsin Industrial Commission and Labor Relations board, spoke on "Wisconsin Labor Relations Law."

T. E. Ward, chairman of the membership committee, announced that 25 new members had been added since the June meeting. V. J. Hydar, chairman of the apprenticeship committee announced plans for the coming year which include attendance of apprentices at chapter meetings and local apprenticeship competition in molding and pattern

(*Concluded on page* 57)

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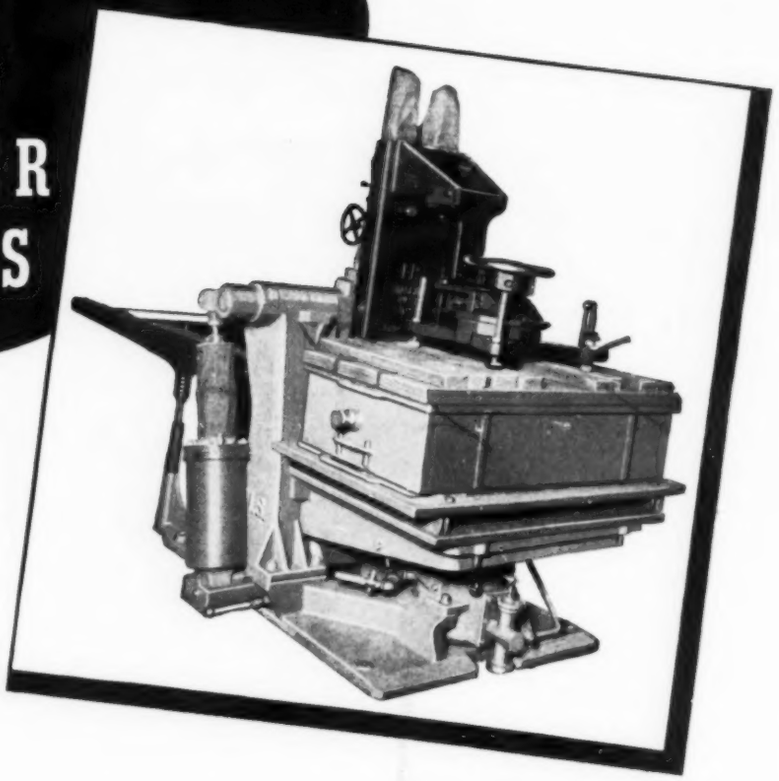


THERE'S NOTHING LIKE THEM FOR CUTTING MOLDING TIME and MOLDING COSTS

● No pits are needed. The center clamping and open end table handles overhanging flasks to the full tonnage capacity of the machines. Two roll-over cylinders, operating reciprocally, prevent stopping on center. Dash-pot control eliminates banging and dropped molds. Complete with an adjustable roll-out table, and a pattern draw that requires no unclamping or equalizing, these Johnston & Jennings machines give you *all* the advantages of air jolt, air clamp, air leveling, air roll-over, air pattern draw . . . and all the savings . . . in one machine. Send for a copy of the fully descriptive folder. It'll give you all details. What are your molding machine requirements?

THREE STANDARD SIZES			
Machine No.	Roll-Over Table	Flask Capacity in Lbs. (at 80 lb. air)	Pattern Draw
610	24" x 30"	600 lbs.	10"
815	30" x 40"	1200 lbs.	15"
918	40" x 48"	2000 lbs.	18"

The JOHNSTON & JENNINGS *Co.*

Addison Road and N.Y.C. Tracks

CLEVELAND . . . . . OHIO

(*Concluded from page* 54)

making prior to the annual A. F. A. convention. Prof. J. Osterle, University of Wisconsin, announced a night course in metallurgy at the University extension, Milwaukee, and asked support of the chapter members.

A special meeting of the chapter on Nov. 21 will be addressed by Whiting Williams, Cleveland. Other groups are participating and an exceptionally large attendance is anticipated.

Northeastern Ohio

FIRST fall meeting of the Northeastern Ohio Chapter, A.F.A., held Sept. 9 at Cleveland was featured by two addresses. R. E. Preston, Standard Oil Co. of Ohio, presented an interesting description of new developments of motor oil for present day engines. Don J. Reese, International Nickel Co., Bayonne, N. J., discussed cupola operations from a practical standpoint. According to Mr. Preston only about 15 per cent of the potential power of gasoline is utilized at present. He anticipates a day in the not distant future when motors and fuels will be developed to a point where a gallon of gasoline will carry a car 150 miles.

In the preamble to his address, Mr. Reese directed attention to the fact that the foundry industry with an estimated annual production of 15,000,000 tons of castings should be listed under the heading of big business. The bulk of these castings is gray iron and the preponderance of gray iron is melted in the cupola. Without doubt, he claimed, the greatest developments in recent years in the metallurgical field have been made in the gray iron field, consequently an intimate knowledge of cupola operation is essential in a field that has become highly competitive.

The speaker divided his subject into three sections: The furnace itself, the accessories and the technique and equipment employed in handling the molten metal. He directed attention to the fact that all three must synchronize for efficient and economical operation. Factors to blame in many instances for unsatisfactory performance include unsuitable blowers, excessive charges, size of material and character of fuel. He went into considerable detail on size and shape of tuyeres, height of bed, position and area of blast pipe, front slagging spouts, size of coke and metal in the charge and varying effects of blast pressures. In concluding he emphasized the importance of providing heated ladles and suitable equipment for transferring metal from the furnace to the molds as rapidly as possible to prevent drop in temperature.

Pittsburgh

AS a prelude to the regular fall and winter series of monthly meetings, Pittsburgh Foundrymen's association on Monday, Sept. 20, visited Mellon institute in Pittsburgh after a dinner at Webster Hall. Attendance for the tour far exceeded expectations of officers of the association, around 160 members turning out for the occasion.

Mellon institute was founded in 1913. It has three major functions: It is a station for research in pure and allied science; it is a school for training research workers, and it is a clearing-house of technical information adaptable to public advantage. Approximately 64 fellowships are in operation at present.

The new building was dedicated May 6, 1937 after 6 years of construction.

Since establishment of the institute, nearly 4000 American companies have been served on problems ranging from food and sleep to glass and steel. Many novel processes and products have been evolved, some of which have resulted in the formation of entirely new industries.

Foundrymen visited the refractories fellowship, chromium fellowship, the food container division, the plastic bureau, the departments studying the soy bean, cotton seed products, cork, rayon, and other products. The engineering laboratories and machine shops attracted considerable interest.

The institute has developed a core binder for a milk company's by-products division. Binding action is said to be concentrated largely but not entirely in the surface, resulting in a hard sharply defined metal contact surface, sufficiently porous to permit ready escape of gases. The interior is said to be porous and friable.

The October meeting of the Foundrymen's association will be held Oct. 18.

New England

NEW England Foundrymen's association resumed its regular monthly meetings on Sept. 8 at the Engineers club, Boston, with a large attendance. Lester B. Knight Jr., vice president, National Engineering Co., Chicago, presented an address on "Sand Reclamation, Conditioning and Control".

Mr. Knight introduced his talk by saying that every up-to-date foundryman should be acquainted thoroughly with his molding sand and the effect of control of such variables as permeability, bond strength and moisture on costs of sand, as well as on the probability of obtaining better castings.

Describing the various tests of molding sands, the speaker pointed out that bond strength and moisture generally are to be considered the principal causes of sand defects in castings. He also called attention to the fact that although bond strength and moisture may be correct for any one molding sand, the clay bond and water in the sand must be distributed uniformly to obtain best results. That point was illustrated by microscopic views thrown on the screen.

Speaking of the effect of sand control, attention was called to the fact that this alone did not guarantee good castings, but the usual attention to gates, risers, design, etc. must be shown. In connection with his talk, Mr. Knight exhibited many interesting lantern slides of molding sand preparation systems. The systems in general consisted mainly of methods of cleaning metallic substances from old sand, removal of fines, adding correct moisture, mulling, screening and aerating.

The point was stressed that during the reclamation process precaution must be taken all along the line to remove dust from the units. In mulling core sand, it was stated that the oil should be added first, and then the water. For best results, sand reclaimed in any good system should be used at once.

Discusses Castings For Enameling

Porcelain Enamel institute, 612 North Michigan avenue, Chicago, recently has published a handbook entitled "Production of Castings for Porcelain Enameling". The booklet, which has been undergoing preparation by the committee on cast iron practice of the institute's technical research section for more than a year, is the result of co-operation between expert foundrymen and representatives of the porcelain enameling industry.

The booklet includes a number of illustrations showing proper and improper designs of castings. It is divided into the following sections: Blistering, warping, influence of design, influence of molding practice, influence of melting and pouring, influence of iron composition and influence of raw materials.

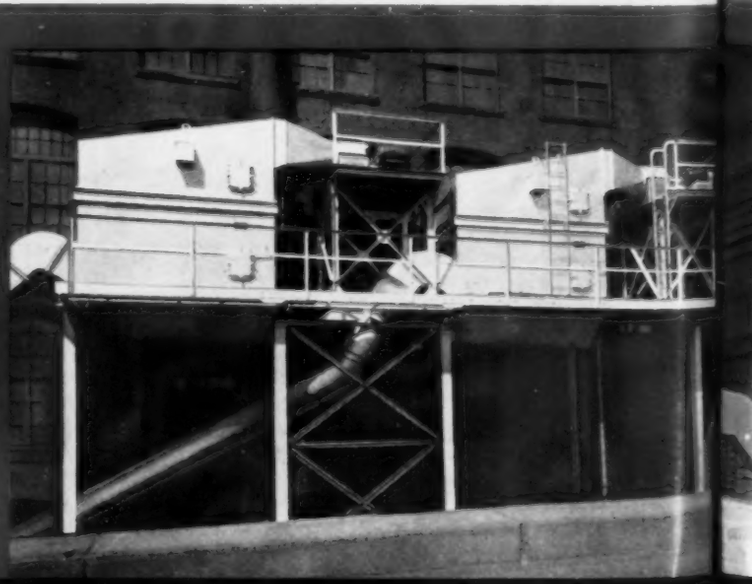
Policyholders' Service bureau, Metropolitan Life Insurance Co., 1 Madison avenue, New York, recently has published a bulletin entitled "The Cash Budget". The presentation reports the results of a rather extensive survey of a number of companies regarding the utilization and scope of the cash budget.

NOT JUST A
But A Whole New Dust
THERE'S NOTHING LIKE AND LOW COST

LABORATORY and field research on the chemical phenomena known as "Surface Tension" conducted by many unbiased investigators, has demonstrated repeatedly that some materials are wetted most easily with water and that others are wetted most easily with oil. From the material available a graph can be constructed—see the diagram below.

Silica (SiO_2, quartz) is wetted most easily with water. Carbon (C-Coke, graphite, etc.) is wetted most easily with oil. Practically all other materials lie between these two. And, since all but the most unusual dusts contain a mixture of different materials ranging from silica on the one hand to carbon on the other, (even foundry dust collected from shakeout sand in a revolving screen has been found to contain less than 70% silica) it is obvious that a thorough wetting of the dust, and that means highly efficient dust collection, requires the use of *both* oil and water. That is why *both* oil and water are used in Bartlett-Snow Dust Collectors as the wetting agent. And that is why their efficiency is so nearly 100%.

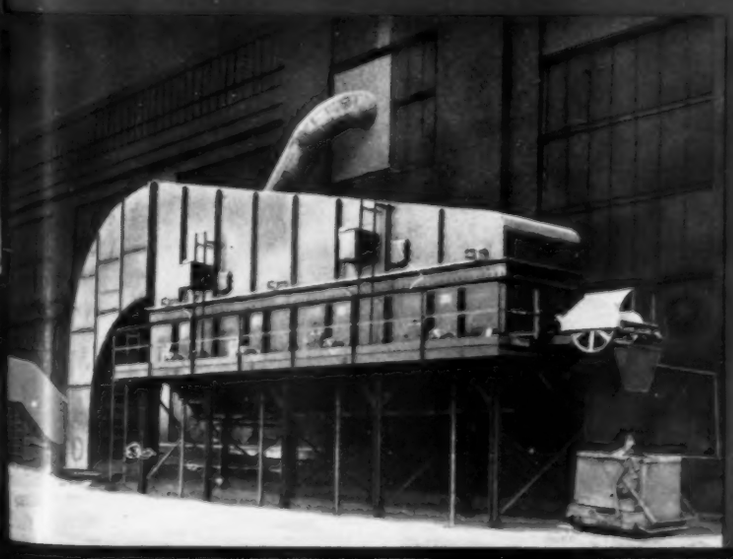
Bartlett-Snow Dust Collectors have demonstrated their efficiency and many operating advantages in some cases for periods exceeding three years. They never yet have failed to receive highest approval from state and local health authorities . . . and offer purchasers the following advantages which are available *only in this design:*



NEW DESIGN . . .
Collecting Principle
IT FOR EFFICIENCY . . .
TROUBLE-FREE OPERATION

1. Lowest resistance to air-flow—only 1.95 inches of water—that is available in any commercially successful dust collector yet devised--and
2. Low power requirement.
3. Continuous operation at efficiencies that are computed in fractions of one per cent less than one hundred per cent . . . absolutely without manual supervision.
4. Elimination of the fire hazard and the many other undesirable features that formerly were considered a necessary evil of dust collector operation.
5. Lowest maintenance cost—eliminating the installation, tearing and replacement of fabric in its entirety.
6. Non-dusty disposal of the collected dust.
7. The handling, with ease, of either dry or wet dust-laden inlet air . . . over the entire temperature range from below freezing to 1800° F. white-hot cupola gases.

Full details of the efficient, low-cost, trouble-free operation that can be yours with Bartlett-Snow Dust Collectors, will be found in the new bulletin—No. 79. It contains a complete description of the equipment and, in addition, more than eight pages of basic and extremely useful engineering data, relating to air-flow through pipes, losses due to branch connections, elbows, etc., and two typical examples showing the use and application of this engineering material in solving actual problems. Send for a copy of Bulletin No. 79 today.



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Last rose of summer blooming alone

The Adventures of Bill

—by Pat Dwyer

IF I am not too inquisitive," said Bill the other night, "do you figure on roosting here in the garage every night after supper, all through the winter just because some of the radio programs burn you up? I admire the excellent judgment which prompted the move in the early part of the summer, but now that the mercury is beginning to shrink in the thermometer, the idea does not seem to be so hot. Escaping from some of the tripey programs is comparable with escaping from a fate worse than death, pet phrase meaning exactly nothing, in the tool kit of novelists and playwrights If you stick around this drafty place much longer you will become converted into an elegant likeness of a shriveled turnip overlooked by the gleaners. Furthermore and in addition thereto, you will have to do it alone. Me for the bright lights and the open fire, or rather the modern equivalent, a steam heated room, radio or no radio."

"Up to the present," I admitted, "I have not given the subject much consideration. Your generous offer to abandon me, suggests that immediate steps must be taken."

"Take 'em into the house and take 'em pronto. This shivery joint reminds me of an episode in the history of a very cute old gent who lives down here a ways in one of the Lake towns. He was and is constitutionally lazy, like some other people I might mention, but he manages to get by without doing a lick of work from one year's end to the other. True, he rates no stars in the crown for living without working in the summer. The stars are awarded for the manner in which he passes the winter, snug and warm and well fed at practically no cost and with the irreducible minimum of physical effort."

"Sounds to me like a very worthy master to imitate. Do you happen to know if he is taking any apprentices or disciples or anything like that?"

"Well," said Bill, "I'll tell you. The old bird is a hermit. I don't think he would object if you sat around and studied his methods, but I am quite sure he would shy away like a startled antelope—not as swiftly of course, but you get the general idea—if you were to pester him for instruction. Anyway, what do you care? He could not teach you anything.

"On second thought, I'll take that back. By watching him closely you might pick up a hint or two on how to heat this place this winter without spending a penny for fuel."

"A really remarkable fellow. Do you think if I were to watch him, say, a little more closely I might learn how to heat the old homestead in the same manner?"

"Don't be a pig. One thing at a time.

"Last winter a wrecking company

Stick around. This looks promising

in the old boy's town tore out some crib work around the breakwater and piled all the timbers up on the shore. Instead of following the usual procedure and burning up the mess, the company let it be known that any person who needed the wood could take it.

"Immediately a swarm of men descended on the pile like a cloud of locusts. Most of the timbers were large and heavy and in addition were bound and studded with straps, bands and long bolts. The men attacked them with saws, axes, hammers and wedges and reduced the pieces to a size that might be carried away in all manner of conveyances from hand carts to baby buggies.

"Our old friend did not claim any of the wood, despite the friendly invitation of his neighbors. They pointed out to him that a long, cold winter was in prospect and he had no credit—as they had none—with the gas men or the coal people. He said nothing, but rambled around apparently aimlessly and picked up all the bolts and straps and things and piled them in one place. Claimed he liked to see things done in an orderly manner. Finally when the mess was cleaned up he invited a junk dealer down to view the pile of scrap. He sold it for $13.20 and bought himself three loads of coal, enough to keep his modest little stove going all winter.

"Talking about different ways of skinning the cat," Bill continued, "or in other words, navigating down the stream of life, reminds me that recently I had a letter from a young man who seems to have all the ear marks of an up and coming foundryman. I do not know him personally, but I should not be surprised to run into him some time in the near future when he holds an important position and attends conventions

(*Continued on page* 62)

SPO Molding Machines

speed-up production

BY:

Insuring rapid mold production with perfect pattern draw; Being so designed so as to meet the exacting requirements of modern foundry practice, thereby increasing your daily output of better castings.

It will pay you to investigate the application of SPO Molding Machines to your production schedules. Mail us sketches of your patterns, together with flask sizes and daily casting requirements. We will gladly make recommendations without obligation.

SPO No. 214 Jolt Squeeze Stripper Molding Machine

SPO

INCORPORATED

Manufacturers of a complete line of Molding Machines and Vibrators

East 61st and Waterman Ave. • CLEVELAND, OHIO

(*Continued from page* 60)

with the other boys who have arrived at or are on the way to the top."

"I know," I said, "I have been all through it. You will sidle up to him, hold out your hand, expose your gold tooth and tell him you are old Bill Buzzard from Bullfrog Creek, Ohio, and he will give you the icy eye and say: 'So what?'

"Take the advice of an old friend and keep away from these up and coming young lads."

"What about the boys who are going down, perhaps for the third time?"

"Ditto, my boy, only more so. Keep your eyes averted or modestly cast down. Keep both hands in your pockets and emulate the smaller species of wart hog when cornered. Scream loudly for help."

"That wart hog stuff is out, definitely. I've seen 'em going up and I've seen 'em coming down. Up to the present I have not been obliged to take a so what, or to seek assistance from the multitude. Anyway you are all wrong in the present instance, or I miss my guess by a long Scandinavian mile. I worked with a Swede up in St. Paul one time who told me the reason the Scandinavian mile is so long is because the early Vikings were sea faring men. Ashore and filled to the tips of their hairy ears with mountain dew, they invariably strayed from their course, tacking from port to starboard and starboard back to port, with the result that they traveled 5 or 6 miles to gain one in a straight line. Time meant nothing to these old boys. Did I ever tell you—"

"Yes," I said, "You did. Throw her back on her course. Try to remember you are not on board the ENDEAVOR. What leads you to think that your correspondent will not bite the hand that fed him? Or, come to think of it, did you feed him? Seems to me you have skipped something in your otherwise exceptionally lucid and dramatic narrative."

"Lucid and dramatic, hey? What a vivid imagination you have, little bright eyes. If you would exercise these same little eyes and big ears to a greater extent and give that long tongue of yours a well needed rest, we might get somewhere. I'll just read you the letter. If you can hold yourself in leash long enough, I might also read you a carbon copy of my reply."

"So you have advanced to the stage where you keep carbon copies of your correspondence. What is the particularly grand idea? Are you by any chance thinking of issuing a book of memoirs?"

"Well," said Bill, "I'll tell you. "Up to the present I had no book in mind. In fact I greatly fear that some of the stuff I have collected would not sit any too well on the printed page. Benvenuto Cellini got away with it and while some of my correspondents could allow Ben a written or spoken handicap of four or five strokes, times have changed and the stuff I have in mind would find acceptance only in the higher class magazines whose readers presumably are immune to contagion. No. The reason I keep carbon copies is rather simple. The charming young creature who knocks out an occasional letter for me does it automatically and I do not think has any idea of what she is writing. Part of her automatic movement consists in slipping a copy sheet into the machine with the original and there y'are. All quite simple when you know the answer. Any further remarks, objections, nosey inquiries or other form of verbal tripe from little Willie Winkle? No? En avant then and likewise alleyoop. In other words, probably necessary in your case, let's go!"

"Also," I warned him, "And probably necessary in your case, no gestures. A fellow just has to draw the line some place. Carry on."

"O.K. No gestures. Listen:

I am a young man 26 years of age and have had about 12 years experience in gray iron and nonferrous practice. In my present position I am one of the best paid molders. I have studied foundry work, blueprint reading, estimating costs and weights from drawings and a little metallurgy. Do you think this foundation qualifies me for a position as a castings salesman? Do large foundries employ men whose sole duty is to estimate costs.

Several technical schools in this section of the country present an opportunity for me to attend evening classes. Would you advise me to do this, and if so what course would be helpful in increasing my knowledge of foundry salesmanship.

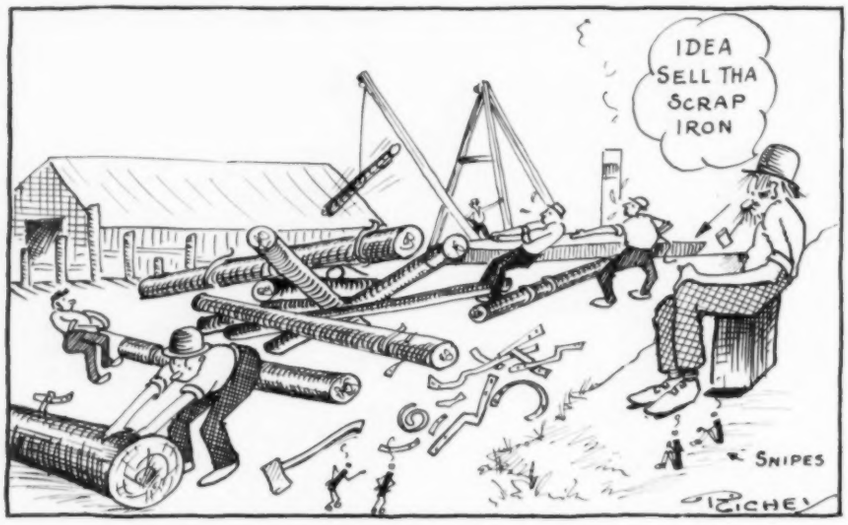
"Sounds to me," I said, "like a rather tough assignment. If he follows your advice and falls down, you are in the dog house. If he has a lucky break and floats to the top—well—anything may happen. What did you tell him?"

"I thought of several things afterward," said Bill, "but at the time I wrote him as follows:

Certainly I appreciate the implied compliment in asking me for advice on the extremely complicated problem of Where Do We Go from Here? That always has been a problem for every person who has taken a definite course of training and I suppose always will be a problem. Apparently there is no royal road. In nearly every case it is just one of those things you work out through a series of trial and error.

However, you seem to have two of the main qualifications necessary to forging ahead. One is continued study of the field in which you are interested, and the other is the ambition to climb the ladder. Another factor in your favor at present—and I confidently expect the condition to continue for several years—it that almost without exception, all foundries are busy. Naturally that means expansion and replacement of men and equipment. In other words a considerable amount of shuffling is going on and a man's chance of fitting into a niche are better than they have been for several years.

Answering your question specifically, many foundries employ men whose sole duty is to estimate costs. In other places where a man has to assume various duties, the ability to estimate costs is a decided asset. From the list submitted of your experience I should say that you are quite qualified to serve as a foundry salesman or any one of several others desirable positions in the foundry business.



Wily one reflects there is more than one way to skin a cat

• If you figure carburizing costs on a part basis, Chrome-Molybdenum (4120) carburizing steel will save several cents per part.

If you figure them on a volume, the savings will run into many dollars.

Chrome-Moly's first cost is lower than that of any other successful alloy carburizing steel. It carburizes with minimum predictable distortion. It machines readily.

Chrome-Moly carburized parts show excellent service records. The steel takes an exceptionally hard, wear-resistant case, and develops good case properties.

This steel has proved an effective answer to the vital question of cutting costs and still maintaining quality. It will well repay investigation. Complete information on request. Climax Molybdenum Co., 500 Fifth Avenue, New York City.

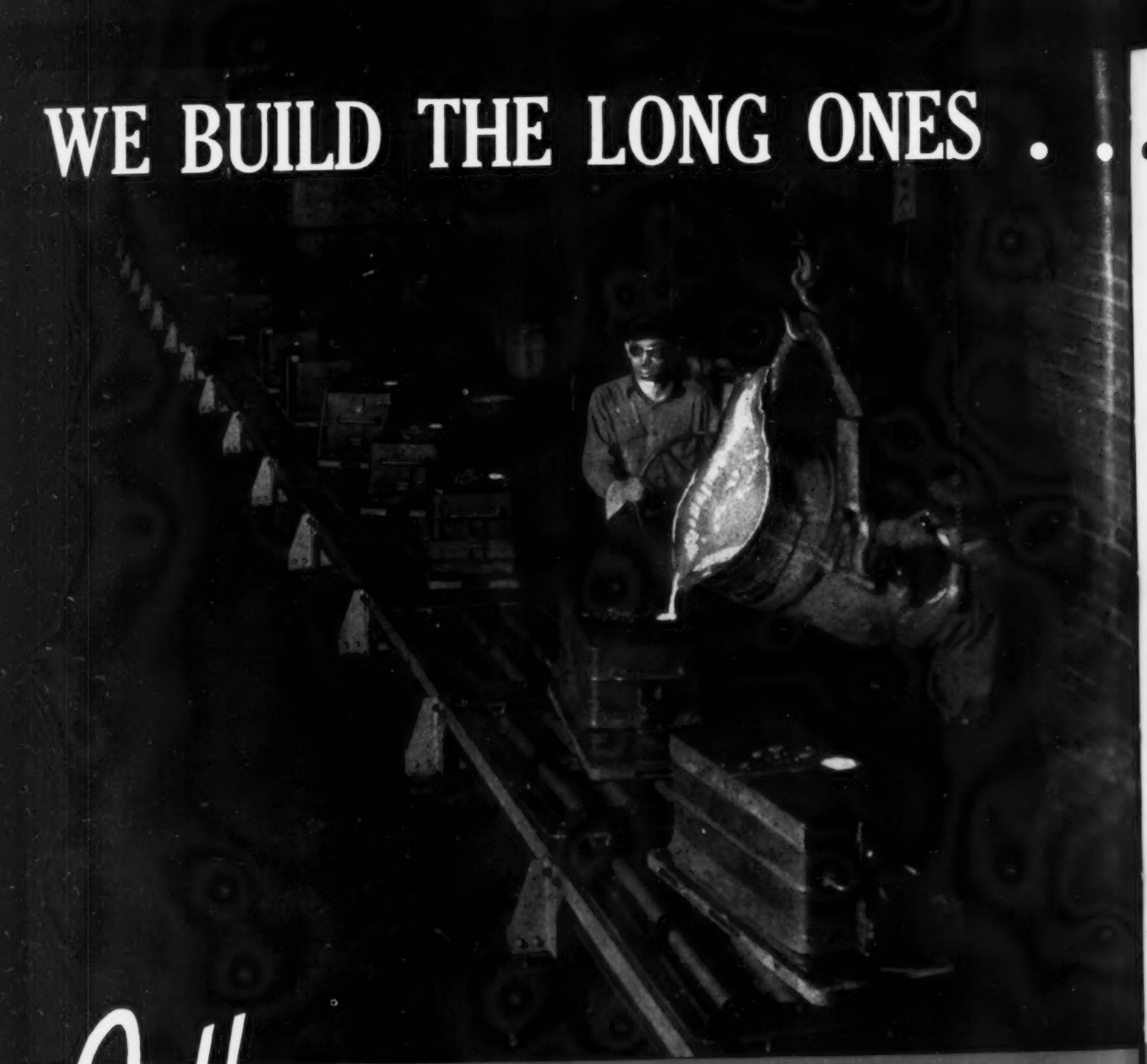
PRODUCERS OF FERRO-MOLYBDENUM, CALCIUM MOLYBDATE AND MOLYBDENUM TRIOXIDE

VISIT OUR BOOTH, C-15, AT THE NATIONAL METALS EXPOSITION

Climax Mo-lyb-den-um Company

MOLY

WE BUILD THE LONG ONES . . .



Jeffrey MOLD CONVEYORS

. . . AND SHORT ONES, TOO

Jeffrey MOLD CONVEYORS

All Shapes and Types

Having smooth, easy-going flexibility, Jeffrey mold conveyors fit the space and line restrictions of any continuous production foundry. They are made to travel uphill or down, and to take almost any desired path horizontally—in the shape of a regular loop, irregular loop, boomerang, horseshoe, hook, or dog bone,

The unusual length of many recent Jeffrey mold conveyor installations, made necessary by present-day cooling time requirements, prove their ruggedness. Repeat orders from nationally known concerns give evidence of the reliability and satisfactory performance of these conveyors. One large production foundry has installed 16 of them . . . there's a type for every service.

Other Jeffrey Equipment for the Foundry

Flask fillers . . sand handling and conditioning equipment . . core crushers . . screens . . mixers . . aerators . . elevators . . conveyors . . Sanditioners . . and maintenance items.

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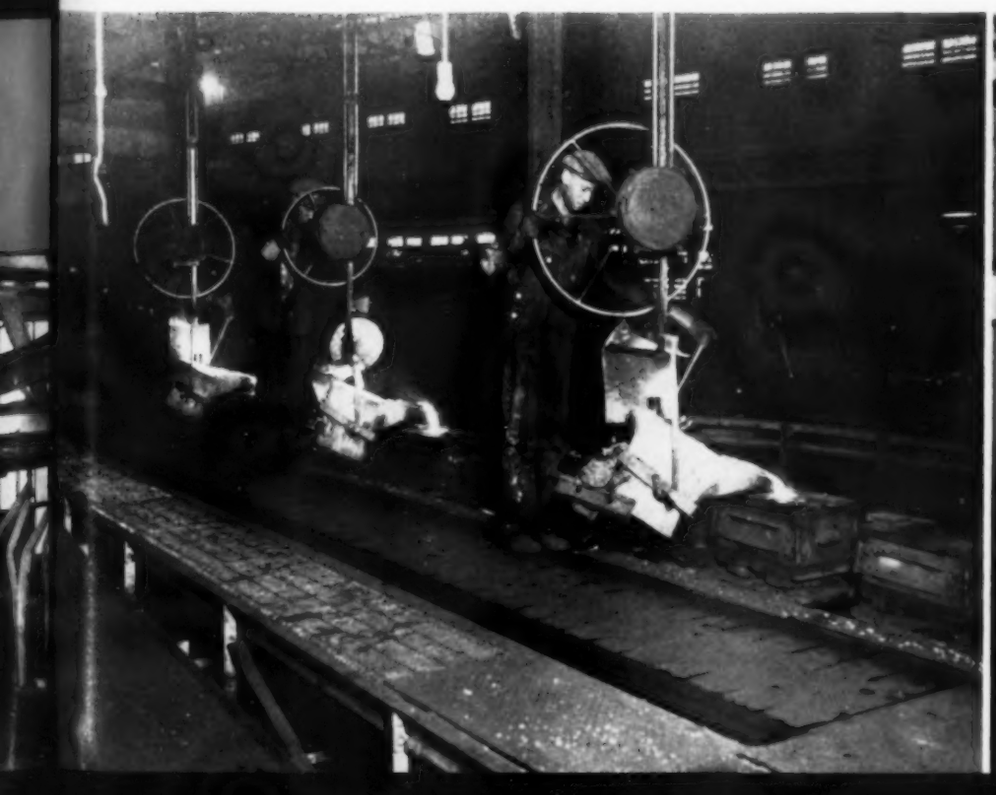
Sales Offices in Principal Cities



VIEWING FOUNDRY DEVELOPMENTS AT SHORT RANGE

SKIN drying should be conducted so that drying is accomplished slowly and evenly. Otherwise the face of the mold may be cracked. Also after skin drying, the mold should be poured before the moisture behind the dried face has an opportunity of creeping back.

* * *

Difficulty from misruns and cold shuts on castings which have large flat areas and fairly thin sections may be overcome by molding and pouring in the horizontal position, and then tilting to the vertical position. The latter may be accomplished by placing trunnions on the flask or by use of special equipment.

* * *

A brass foundry operated in connection with a gray iron foundry received an order for several heavy manganese bronze castings which were far afield from its regular line of work. The manganese bronze was specified to contain 1.5 *per cent iron, and that addition was made by taking the requisite amount of molten iron from the cupola spout.*

* * *

Steel mill pinions 20 inches in diameter with a 22-inch face were cast of an alloy steel containing 0.35 per cent carbon; 0.68 per cent manganese; 0.32 per cent silicon; 1.48 per cent nickel; 0.72 per cent chromium, and 0.36 per cent molybdenum. After pouring they were shaken out of the mold while still hot, and annealed at 1650 degrees Fahr., followed by heating to 1700 degrees Fahr., and holding for 5 hours. Then they were air cooled, reheated to 1650 degrees, and again air cooled. Following that double normalizing, the castings were heated to 1600 degrees Fahr., held for 5 hours, quenched in oil, drawn at 1200 degrees Fahr. for 10 hours and then cooled.

* * *

It is claimed that wiping goggles and glasses with a clean rag dipped in glycerine will eliminate to a large degree the fogging which occurs during muggy, humid weather.

* * *

MALLEABLE cast iron spike grid connectors similar to that shown in the accompanying illustration have been developed for strengthening timber joints. Three types are made for application between two sawed timber faces, between a pile and a sawed timber face, and between two piles or poles.

* * *

A recently developed plastic refractory for monolithic ladle linings is claimed to be more resistant to the corrosive action of soda slags than ordinary ladle brick, and it does not cut out.

* * *

Removal of inclusions providing a clean iron, and improvement of physical properties are claimed for a new fluxing material described in a recent patent. The fluxing material essentially is composed of barium compounds with some sodium chloride. One suggested mixture contains equal parts of barium sulphate and barium carbonate briquetted with sodium silicate or pitch, and 2 per cent sodium chloride. From 2½ to 5 pounds of the material are added to a ton of iron.

* * *

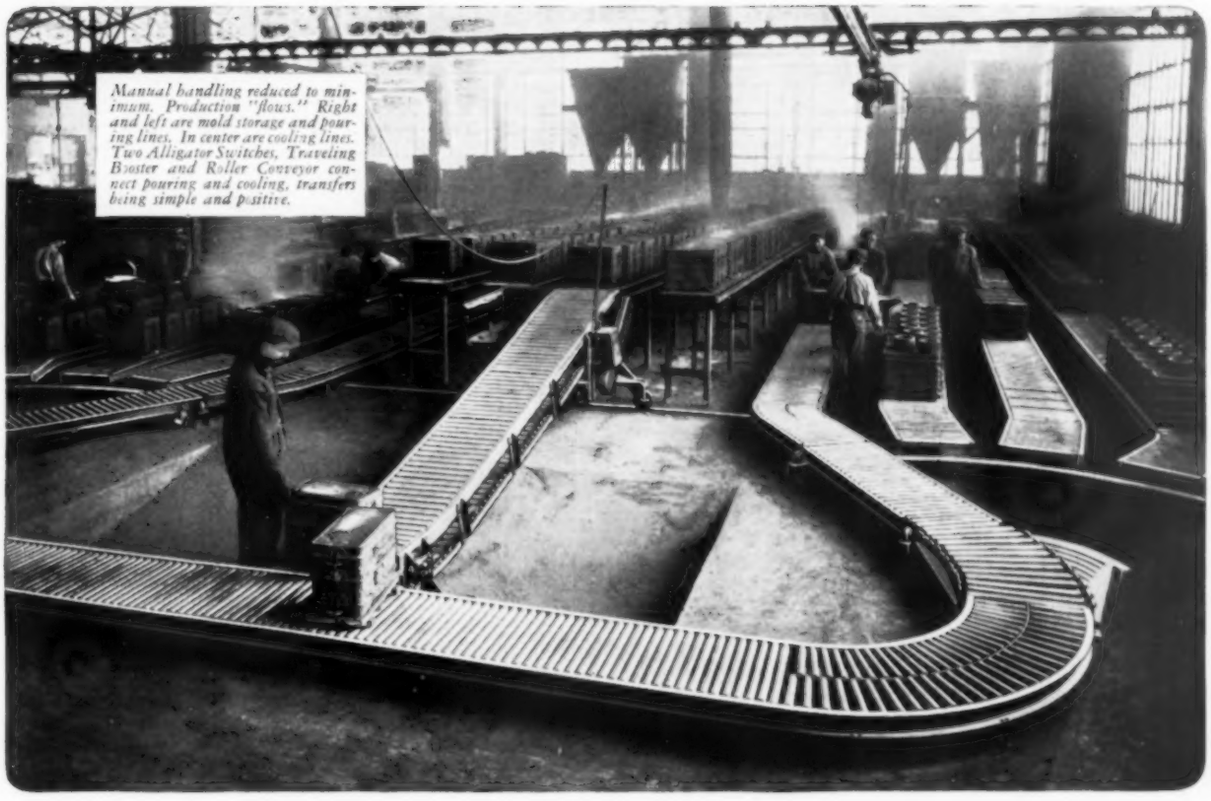
A new weighing scale designed for earning revenue from advertising displays near the top of the column and from the pennies inserted by those using the scale, includes in its construction a base and lower portion of the column made of cast iron decorated with porcelain enamel in two tones.

* * *

It is said that to obtain the best results with seacoal, the sand and seacoal should be of the same approximate fineness, to allow the escape of gases from and through the mold as readily as possible.

* * *

IN a new type molding machine developed by a French engineer the pattern plates are mounted on a revolving table which bring the molds in turn under two squeezing heads. Special attachments on the first head squeeze the sand into pockets, around the edges and other difficult areas. The second head completes the operation. To accommodate several different types of patterns, the squeezing heads are mounted on a drum and the drum is revolved to bring any required head into play. Filling the flasks with sand and all other operations are entirely automatic. It is claimed that a machine with 8 stations can be operated by a single operator and that an output of 220 parts or 110 complete molds can be secured per hour.



Manual handling reduced to minimum. Production "flows." Right and left are mold storage and pouring lines. In center are cooling lines. Two Alligator Switches, Traveling Booster and Roller Conveyor connect pouring and cooling, transfers being simple and positive.

MAXIMUM RESULTS *from* MINIMUM EFFORT

★Sounds like a paradox, but it's true—*best results* are obtained along foundry production lines *where effort is reduced to the lowest point.* . . . In virtually every phase of foundry operation Logan Conveyors fit-in to take the *effort* out of production, leaving men free to exercise skill and ability. But that is not all. Logan equipment, by its very nature, links up all operations, making them as one smooth-flowing whole. . . . Considering the possible savings in Effort, Time, Space, is your foundry as fully equipped with conveyors as it might be? . . . If you have a conveyor problem in mind now or one that's coming up later, call in the nearest Logan engineer, or write for new Bulletin 15.

Alligator Switches used also at molding stations to serve pouring lines.

LOGAN CO., Incorporated, Louisville, Ky.
580 Buchanan St.

MOVING IS 90% OF MAKING

Logan Conveyors
LOUISVILLE

European Foundry Practice

Digest of Recent Literature Covering Various Phases of Castings Manufacture

Heat Treatment

Heat Treatment of Large Nickel-Chromium Steel Castings, by J. Obreski, *Foundry Trade Journal*, London, England, Sept. 2, 1937.

Proper heat treatment of large steel castings is difficult when quenching is involved due to the large tanks and lifting equipment required. Consequently, other means such as water-spraying or cooling by compressed air, or a combination of both may be used depending upon the composition of the steel. The author sought to develop a suitable method of heat treatment for large castings which had a composition: Carbon, 0.30 per cent; nickel, 3.52 per cent; chromium, 0.89 per cent; manganese, 0.70 per cent; silicon, 0.34 per cent; sulphur, 0.02 per cent, and phosphorus, 0.015 per cent.

In his investigation he used forged test specimens from the same heat as he states that the heat treatment giving the best results on forged specimens will be the most favorable for the casting, and forging of the test pieces will permit a certain number of accidental faults to be avoided. Results of his work led to the following conclusions:

(1) If a casting be quenched by water spraying, one can cool slowly down to 600 degrees Cent. (1112 degrees Fahr.). (2) Between 600 and 400 degrees Cent. (1112 and 752 degrees Fahr.) it is necessary to cool specially rapidly, after which cooling can be slowed down. Considerable hardness after quenching will be obtained as well as a sorbitic structure without a ferritic network. (3) If it is considered that quenching by immersion or even by water-spraying is impossible or dangerous, the standard treatment (quenching and tempering) can be replaced by the author's new method which consists in heating the casting up to 850 degrees Cent. (1562 degrees Fahr.), cooling it at any speed down to 550 degrees Cent. (1022 degrees Fahr.), holding for 3 hours, and reheating afresh to 650 to 680 degrees Cent. (1200 to 1240 degrees Fahr.) for an hour and then after having removed the casting from the furnace, cooling as quickly as possible down to 300 degrees Cent. (572 degrees Fahr.).

The author claims that after that heat treatment the mechanical properties will not be any less than those obtained by orthodox hardening and tempering. The tensile strength is the same; the yield point falls by 9.5 tons (21,280 pounds) per square inch while the resilience is reduced only by 2 to 3 kg.-m. per square cm. (Mesnager machine).

Electric Furnaces

Electric Melting Furnaces (Les Fours Electriques de Fusion), by Marcel Fourment, *Bulletin* de L'Association Technique de Fonderie, Paris, France, November, 1936.

In this article which is in French, the author mentions that the subject of electric furnaces is an extremely broad one which hardly can be discussed in detail, and that his purpose is to review the subject briefly and call attention to the developments and more recent tendencies in the field. Electric furnaces are divided into three classes: Resistance type; induction type, and arc type. Resistance furnaces may have metallic resistors, nonmetallic resistors, and liquid resistors. Metallic resistors may be 80 per cent nickel, 20 per cent chromium, or 10 to 30 per cent chromium, 5 to 6 per cent aluminum, and remainder iron. Such furnaces have certain disadvantages, and generally are used only for low melting point alloys.

Nonmetallic resistor furnaces employ carbon or carbide of silicon resistors. In this type the author mentions a French development in which a large cylindrical graphite resistor coated with refractory material is being used in the melting of cast iron. In the liquid resistor type furnace, a molten metal bath through which the current is passed is the principle employed. On the subject of induction furnaces, the author mentions both low and high frequency types, and states that recently some of the latter type have been designed to operate on a frequency of 50 cycles. The author also describes the arc type furnaces, their advantages and disadvantages.

Aluminum Alloys

Viewpoints on the Selection and Production of Aluminum Alloys (Gesichtspunkte bei der Wahl und Herstellung von Aluminiumgusslegierungen), by Dr. A. von Zeerleder, *Die Giesserei*, Dusseldorf, Germany, June 18, 1937.

The most important aluminum alloys used in the foundry are summarized in the German standard specification No. 1713 which includes 9 alloys marked as follows: GA1-Cu, 7 to 9 per cent copper; GA1-Zn-Cu, 2 to 5 per cent copper and 8 to 12 per cent zinc; GA1-Cu-Ni, 4 per cent copper, 2 per cent nickel, and 1.5 per cent magnesium; GA1-Si, 11 to 14 per cent silicon; GA1-Si-Cu, 0.8 per cent copper, 11 to 14 per cent silicon, and 0.3 per cent manganese; GA1-Si-Mg, 11 to 14 per cent silicon, 0.3 per cent magnesium, and 0.5 per cent manganese; GA1-Mg, up to 1.5 per cent silicon; 4 to 12 per cent magnesium, up to 1 per cent manganese, and up to 1 per cent antimony; GA1-Mg-Si, 2 to 5 per cent silicon, 0.3 to 2 per cent magnesium, and 0.5 to 1 per cent manganese, and GA1-Mg-Mn, 2 to 4 per cent magnesium, 1.2 to 1.5 per cent manganese, and up to 0.2 per cent titanium.

Grades GA1-Cu, GA1-Zn-Cu, GA1-Si, GA1-Si-Cu, GA1-Mg, and GGA1-Mg-Mn are not hardenable and depending on wall thickness and casting conditions, sand castings will show tensile strengths from 12 to 20 kilograms per square millimeter (17,100 to 28,500 pounds per square inch) with elongations from 0.5 to 4 per cent, and chilled castings will show tensile strengths from 14 to 24 kilograms per square millimeter (20,000 to 34,150 pounds per square inch) with similar elongation.

The other grades through heat treatment and rapid cooling are hardenable, and the tensile strengths of sand castings lie between 22 and 28 kilograms per square millimeter (31,300 and 39,900 pounds per square inch). Chilled casting tensile strengths are between 25 and 32 kilograms per square millimeter (35,600 and 45,500 pounds per square inch). Elong-

(*Concluded on page* 70)

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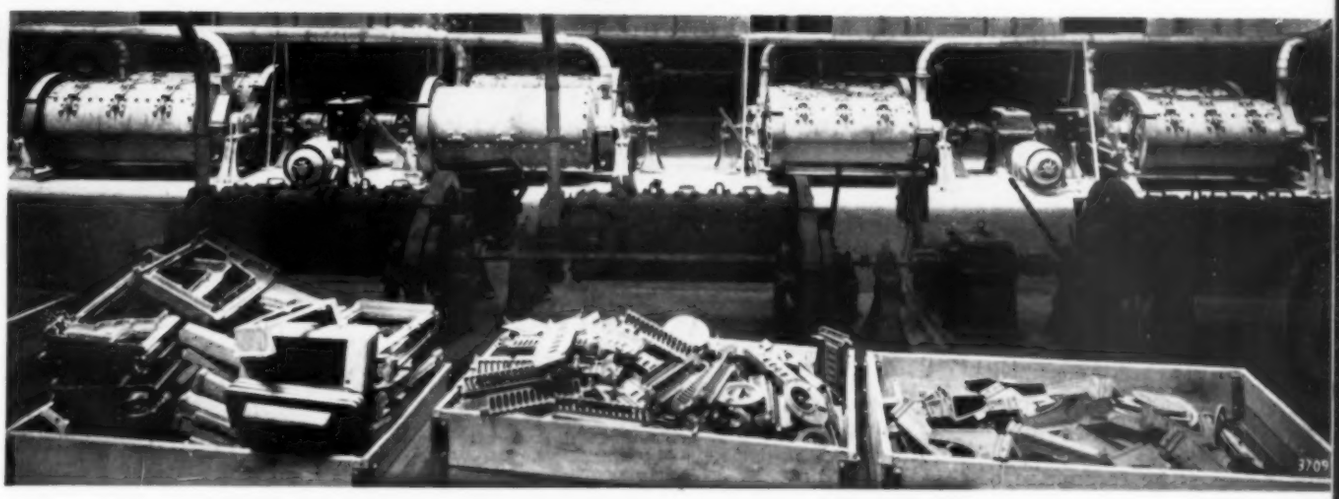

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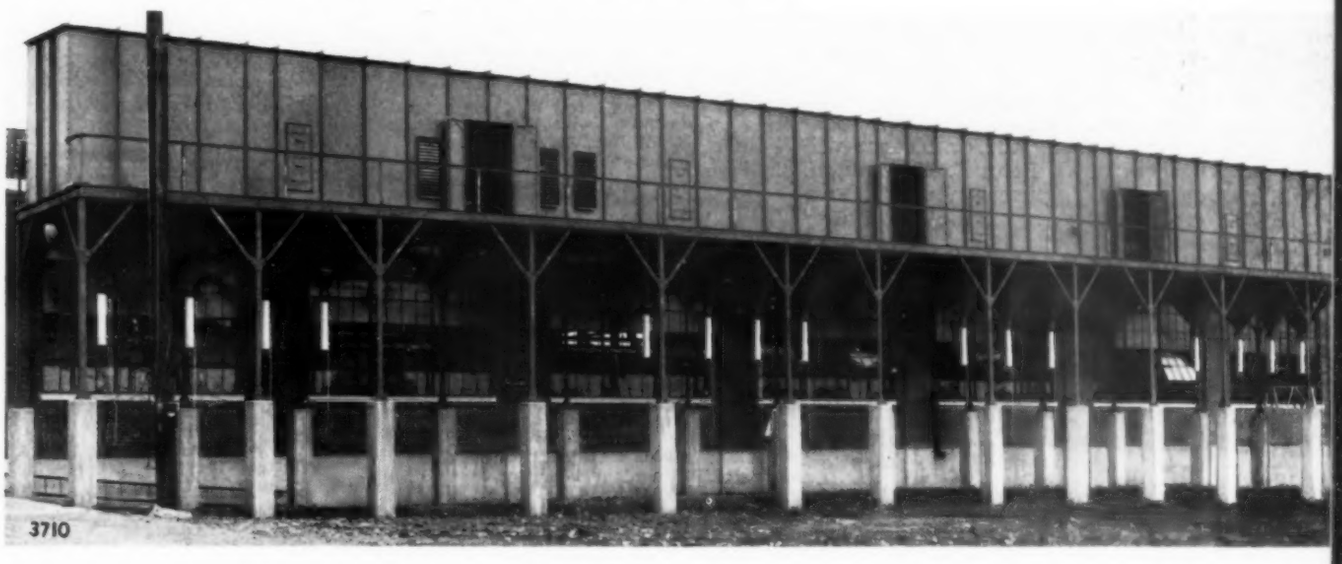

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(*Concluded from page* 68)

ations are from 0.5 to 2 per cent.

In general as the section thickness increases the tensile strength of the alloys decreases due to effects of slow cooling. Consequently, chilled castings show higher strengths, and in sand castings use of chills will give better properties for heavy castings.

The author points out that due to the wide variety of compositions available in scrap form, the foundryman must know definitely what he is purchasing, or he will run into difficulties. For quality castings melting must be done properly. Iron pots should be coated to prevent absorption of iron, and a suitable material is composed of 50 per cent clay substance containing 8 per cent silica, 45 per cent water, and 5 per cent waterglass (sodium silicate). Determination of whether or not the metal is gas-free may be accomplished by casting small test pieces 1.5 inches in diameter and 2 inches high in open sand molds. With gassy metal the upper surface wells while with gas-free metal the surface pipes or shrinks strongly.

Plan Two Day Conference at the University of Iowa

A TWO day conference will be held at the University of Iowa, Iowa City, October, Oct. 29 and 30, by the American Foundrymen's association in co-operation with the University, the Quad City Chapter ter of A.F.A., and the Northern Iowa Foundrymen's association. This is the second annual foundry conference devoted to various phases of foundry practice.

The committee of the Quad City chapter, which has developed a program in co-operation with A. V. O'Brien, University of Iowa, consists of T. J. Frank, Frank Foundries Corp., Moline, Ill.; Horace Deane and E. A. Gullberg, Deere & Co., Moline, Ill.

Registration headquarters and all meetings will center at the Engineering building on the university campus. The opening session will be at 9:30 a.m., Friday, Oct. 29, when those attending the conference will be greeted by Dean F. M. Dawson, college of engineering. P. T. Bancroft, chairman of the Quad City chapter, Moline, Ill., will preside. The Friday morning program will be devoted to the discussion of problems relating to sand.

The afternoon session will cover testing and melting in various phases. Dinner will be held at 7 p.m. in the Iowa Student Union building at which H. O. Croft, head of the department of mechanical engineering, will preside as toastmaster. Principal addresses will be given by Eugene Gilmore, president, University of Iowa and H. Bornstein, Deere & Co., and president of the American Foundrymen's association.

Sessions Saturday morning will be devoted to nonferrous subjects and to alloy cast iron. The afternoon is left free for inspection of the engineering buildings, golf recreation.

The tentative program is as follows:

Friday Morning, Oct. 29

9:00 a.m.—Registration

9:30 a.m.—Opening meeting

Address of Welcome, Dean F. M. Dawson, College of Engineering

Response, P. T. Bancroft, Chairman, Quad City Chapter, A. F. A.

10:00 a.m.—SAND PROBLEMS

Chairman, P. T. Bancroft

"Sand Control," by H. W. Dietert, Harry W. Dietert Co., Detroit

"Natural Molding Sands," by C. M. Hardy, Houghland & Hardy Co., Evansville, Ind.

2:00 p.m.—TESTING AND MELTING

Chairman, A. V. O'Brien, University of Iowa

"Physical Tests of Cast Metals," by H. L. Daasch, Iowa State college, Ames, Iowa.

"Analysis of Iron," by John Fielding, State University of Iowa, Iowa City, Iowa.

3:30 p.m.—MELTING PRACTICE

Chairman, John Ploehn, French & Hecht Inc., Davenport, Iowa.

"Foundry Coke," by Lewis D. McClaren, Republic Coke & Gas Co., Chicago.

"Operation of Cupola," by W. R. Bean, Whiting Corp., Harvey, Ill.

"Cupola Practice," by Garnet P. Phillips, International Harvester Co., Chicago

7:00 p.m.—DINNER — Iowa Student Union Building

Toastmaster, H. O. Croft, professor and head, department of Mechanical engineering

Addresses: Eugene Gilmore, president, University of Iowa; H. Bornstein, president, American Foundrymen's association and director of laboratories, Deere & Co., Moline, Ill.

Saturday, Oct. 30

8:30 a.m.—NONFERROUS METALS

Chairman, John H. Diedrich, Blackhawk Foundry & Machine Co., Davenport, Iowa.

"Metallurgy of Nonferrous Castings," by C. O. Thieme, H. Kramer & Co., Chicago

9:30 a.m.—ALLOY CAST IRON

Chairman, A. E. Hoegeboeck, Frank Foundries Corp., Moline, Ill.

Speakers: R. G. McElwee, Vanadium Corp. of America, Detroit
E. K. Smith, Electro-Metallurgical Co., Detroit
V. A. Crosby, Climax Molybdenum Co., Detroit
Fred J. Walls, International Nickel Co., New York

P. M.—Inspection of Engineering buildings.

National Founders Plan Meeting

The annual meeting of the National Founders' association, will be held at the Waldorf-Astoria, New York, on Wednesday and Thursday, Nov. 17 and 18.

The following tentative program has been prepared:

Tuesday, Nov. 16

10:00 a.m.—Meeting of Administrative Council.

7:00 p.m.—Alumni Dinner.

Wednesday, Nov. 17

Business Sessions.

Noon—Complimentary Luncheon.

Thursday, Nov. 18

Morning—Business Sessions.

Afternoon—Meeting of the new Administrative Council.

Annual Meeting of Acetylene Group

The thirty-eighth annual convention of the International Acetylene association will be held in Birmingham, Ala., on Nov. 10, 11 and 12. The following papers of interest to the foundry industry will be heard on the program: "Metallurgical Problems in Bronze Welding Cast Iron Pipe," by J. T. MacKenzie, American Cast Iron Pipe Co., Birmingham; "Welding of Cast Iron Pipe," by C. L. Lane, Walworth Alabama Co., Birmingham. Lester N. Shannon, vice president, Stockham Pipe Fittings Co., Birmingham, will preside at the session at which these papers are to be presented.

To Hold Conference At Cornell

A foundry conference sponsored jointly by Cornell university, the Buffalo Chapter of the American Foundrymen's association, the foundrymen of Northwestern New York, and the American Foundrymen's association, will be held at Cornell university, Ithaca, N. Y. on Nov. 26 and 27. Complete details of the program will be announced in the November issue of THE FOUNDRY.

Cutler-Hammer Inc., Milwaukee, recently has opened an office at 539 Gravier street, New Orleans, with Joseph Gardberg as manager.

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Discuss Nonferrous, Steel, and Gray Cast Iron Problems

AN EXCELLENT program, covering the technical phases of nonferrous, steel and gray iron foundry practice, featured the Fall technical foundry conference held at Columbus, O., Sept. 30 and Oct. 1, under the joint sponsorship of Battelle Memorial institute and the American Foundrymen's association. The attendance exceeded expectations with approximately 200 present. The territory represented by those attending the meeting was exceptionally large, extending from the Atlantic seaboard to the Mississippi, and from northern Michigan and Wisconsin to Birmingham, Ala. Robert E. Kennedy, technical secretary, American Foundrymen's association, Chicago, opened the meeting Thursday afternoon on behalf of the A. F. A. and Battelle.

The Thursday afternoon meeting was devoted to the discussion of nonferrous problems with Dr. H. W. Gillett, chief technical advisor, Battelle Memorial institute, Columbus, O., presiding.

Chromium and Copper

Dr. Bruce Gonser, supervising metallurgist, Battelle Memorial institute, led the first discussion on "Effects of Chromium in Copper-Base Alloys." Dr. Gonser explained that there are two factors in connection with the chromium problem, the first dealing with the use of the alloy to secure certain properties in the nonferrous casting, and the second the methods used to remove chromium from the alloy when it is present in scrap used and not desirable in the finished casting. In making an alloy to which chromium is to be added, the metal is melted down first, is deoxidized, and the chromium is added last. The addition is made in the form of a copper-chromium alloy with about 6 to 10 per cent chromium. Recovery is low when the pure chromium is added, tests indicating a recovery of approximately 40 per cent.

Since chromium oxidizes easily, it is best to use a slag on the melt. This may be made of glass, fluorspar, borax, boracic acid, salt, etc. The speaker mentioned that charcoal was not recommended, but in the discussion several of those present stated that charcoal was being used with entirely satisfactory results. The solid solubility of chromium in copper is only 1 per cent. Experimental work has shown that phosphorus and chromium do not work together readily and that it is best to have as little iron in the mixture as is possible.

Since a chromium-copper alloy looks dull when heated, usually the pouring temperature is on the hot side. In taking a temperature reading with a pyrometer, it is necessary to push the slag back to secure an actual reading of the surface of the metal. The chromium-copper alloy should be held the shortest possible time in the furnace after addition of the chromium and it should be poured at low temperature to secure the highest recovery.

Adds to Hardness

To eliminate chromium from a melt, the opposite procedure is followed. Oxidizing through superheating will remove the greater portion of the alloy. Each time that an alloy containing chromium is remelted, a good portion of chromium is lost. However, greater difficulty is encountered when the amount of chromium is exceptionally small.

The speaker pointed out that chromium adds to hardness and strength. At the same time it lowers the conductivity very little. Experience of several, indicated that conductivity of a chromium-copper alloy would be 85 or higher. Dr. Gonser also discussed the age-hardening properties of chromium alloys. For best results it was found that from 0.5 to 0.6 chromium should be used. In the discussion, E. R. Darby, metallurgist, Federal Mogul Corp., Detroit, mentioned the difficulty in casting the copper chromium alloy. He stated that while excellent results can be obtained in the laboratory, many difficulties are encountered in the foundry.

He spoke of experiments which have been made in adding phosphorus somewhat beyond the deoxidizing point. Difficulty is encountered in keeping the phosphorus under control and in maintaining the balance of phosphorus and chromium. He stated that not much difficulty is encountered in using a certain amount of the copper-chromium alloy gates in the regular melts. He has found that remelting gates and sprues of the copper-chromium alloy decreases the conductivity each time that a remelt is made.

The second portion of the Thursday afternoon program dealt with "Melting Methods in the Nonferrous Casting Industry," with Harry M. St. John, metallurgist, Detroit Lubricator Co., Detroit, a discussion leader. Mr. St. John suggested that the problem is divided into two sections, the first that of securing metallurgical results to make possible sound and satisfactory castings. The second portion to be considered is economy in melting. Mr. St. John stressed the fact that given sufficient skill and experience, any type of melting equipment in commercial use can be used to make as good castings as can be produced by any of the other methods. Conversely, lacking sufficient skill and experience, regardless of equipment, satisfactory castings cannot be made. Incidentally, this thought was elaborated upon by practically every man who took part in the discussion.

Control the Melting

Mr. St. John pointed out that all factors in connection with the melting operation have to be recognized and kept under control. He stated that economy in loss of metal has been a point of advantage in melting electrically. At the same time he brought up the disadvantage in that those things which are put into the furnace as part of the charge, and which are not desired in the casting, still are in the metal when it is poured into the mold. Most cases of failure in any type of melting equipment may be blamed on lack of proper supervision, lack of experience, prejudice, etc.

The session on Friday morning was devoted to steel castings with E. W. Campion, president, Bonney-Floyd Co., Columbus, O., presiding. Walter Crafts, Union Carbide & Carbon Co., Niagara Falls, N. Y., led a discussion on "Effects of Alloys on Cast Steels." Mr. Crafts stated that in the low alloy field, alloys are added to affect the strength and ductility by cutting down mass effect. The speaker presented a number of slides to show the effects of various alloy combinations on the properties of the castings.

He spoke of hot tearing in steel castings and discussed results where a casting was poured in a mold

made of fine silica flour. In his opinion the silica reacted chemically to take the oxygen from the metal. This was questioned during the discussion, and P. E. McKinney, metallurgical engineer, Bethlehem Steel Co., Bethlehem, Pa., attributed the difficulty to the lack of permeability in the silica flour mold. Mr. McKinney also referred to the work of Briggs and Gezelius on shrinkage.

In the second section of the Friday morning session, C. E. Sims, supervising metallurgist, Battelle Memorial institute, led the discussion on "The Effects of Aluminum on Physical Properties of Steel Castings." Mr. Sims stated that aluminum has been used as a deoxidizer as far back as 1859. While in steel foundry practice the use of the alloy does not always prove beneficial, nevertheless foundrymen are willing to suffer the disadvantages to obtain the benefits derived from its use. The speaker discussed a study started a year ago at Battelle on aluminum additions.

Aluminum acts to lower the ductility through the effect on the distribution and arrangement of the sulphides. In the discussion, Fred A. Melmoth, vice president, Detroit Steel Casting Co., Detroit, presented the opinion that aluminum affects the silicate as well as the sulphide inclusions.

The work described by Mr. Sims was in connection with plain carbon steels so that the fundamental relationships might be obtained. The results of the investigation indicate that many discrepancies in the use of aluminum may be attributed to the varying amount of sulphur in the steel. While various suggestions were presented as to the amount to be added, the general concensus of opinion seemed to favor 24 ounces of aluminum to the ton of steel.

Discuss Cast Iron

Battelle Memorial institute provided a complimentary luncheon on Friday noon at Pomerene hall, on the campus of Ohio State university. Both Friday sessions were held at Campbell hall since the attendance at the meeting was greater than could be handled in the auditorium in the Battelle Memorial institute building.

The Friday afternoon session was devoted to "Relation of Structure to Properties of Cast Iron," with Hyman Bornstein, president, American Foundrymen's association, and director of laboratories, Deere & Co., Moline, Ill., presiding. John W. Bolton, metallurgist, Lunkenheimer Co., Cincinnati, was the discussion leader on "Cupola Cast Irons." He stated that the so-called strength properties depend on three things, namely microstructure, density and degree of freedom from internal stresses.

The often demonstrated close relationship of graphite, amount, size and distribution, to strength, indicates that the graphite structure in usual foundry irons is a more important matter than percentages of combined carbon. The speaker stated that the secret of high strength irons lies largely in control of carbon content, and especially in artful manipulation of the furnace. For most practical purposes, total carbon content may range from around the effective eutectic concentration with the weaker irons to around 2.70 per cent with high steel charges used in high strength irons.

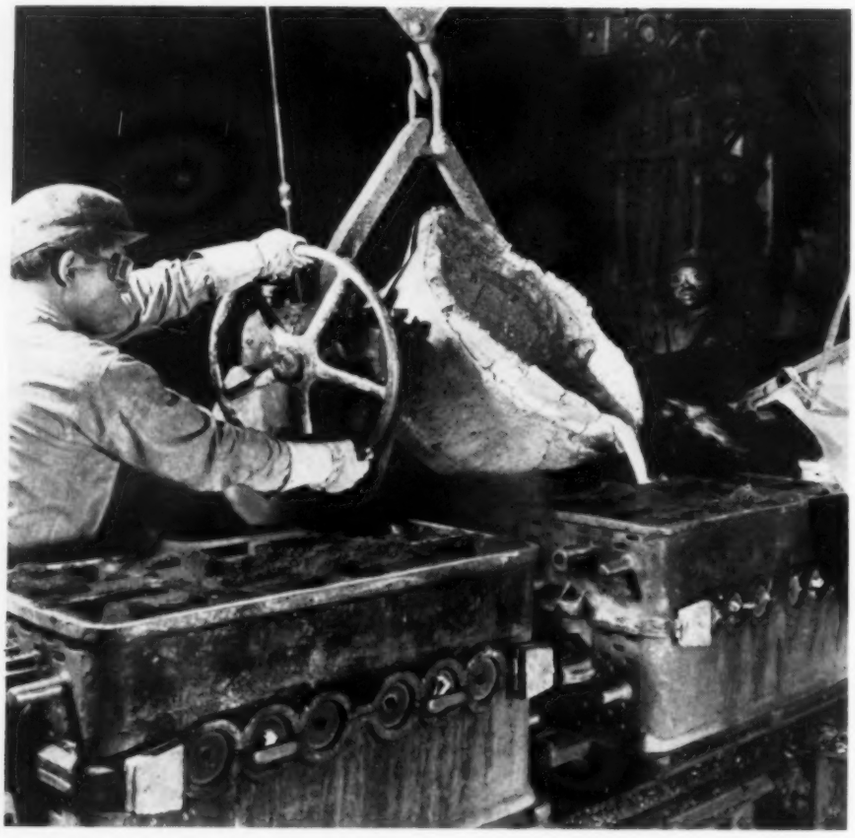
Other Factors Responsible

Mr. Bolton raised the question as to whether differences often observed between cupola and electric furnace iron of like nominal composition, are attributable fully to differences in temperature found in melting in the respective media. He believes that in focusing attention on temperature alone, factors of time and gaseous atmosphere are forgotten. He cited as an example the air furnace which may produce quite strong iron at relatively low temperature, but with the metal held in the molten condition for long periods. The time may permit coagulation of slag particles, or the completion of certain reactions in the liquid metal. Mr. Bolton also brought up the point that in his opinion there must be something in the graphite which adds to the strength of cast irons.

Richard Schneidewind, University of Michigan, Ann Arbor, Mich., was discussion leader for the second section dealing with "Electric Furnace Iron." The speaker discussed frankly the advantages and disadvantages to electric melting. Under advantages he listed versatility; close chemical control after the operator has learned the characteristics of a particular furnace; temperature control; ability to superheat; ability to produce low carbon, high strength cast iron and the possibility of using low grade raw materials. Under disadvantages he indi-

(*Concluded on page* 78)

Makes New Record in Pouring Iron



MODERN equipment, organization, and skilled workers at the Chevrolet gray iron foundry, Saginaw, Mich., combined to bring about a new record of 2306 tons of molten iron poured in a single day recently. Traveling electric cranes carrying large ladles receive the metal from the cupolas in which it is melted, and speed it about the plant to be transferred to smaller casting ladles, from which it is poured into molds to form cylinder blocks, pistons, clutch housings, and other castings. The accompanying illustration shows pouring of a cylinder block casting

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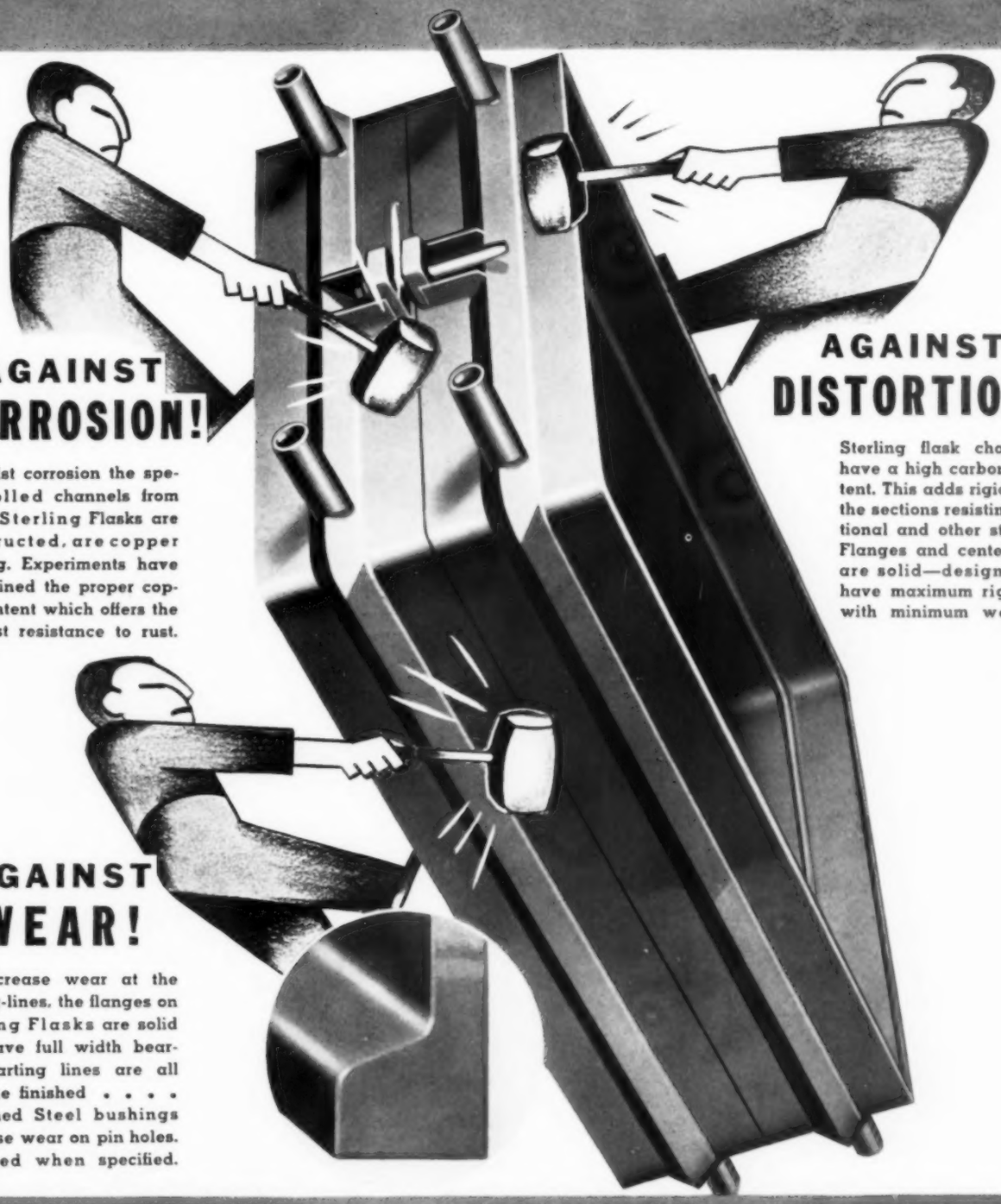

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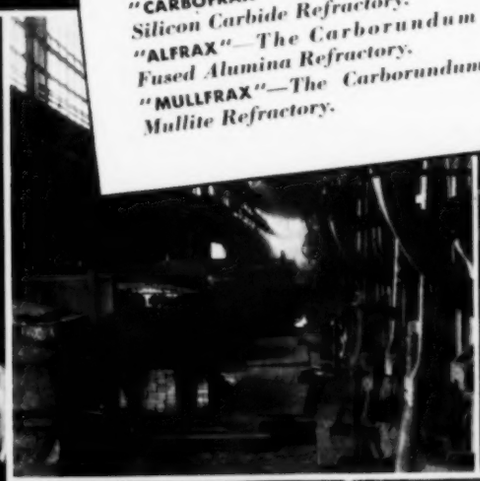

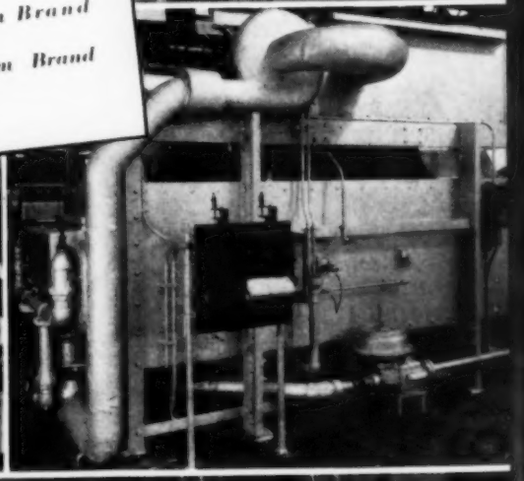

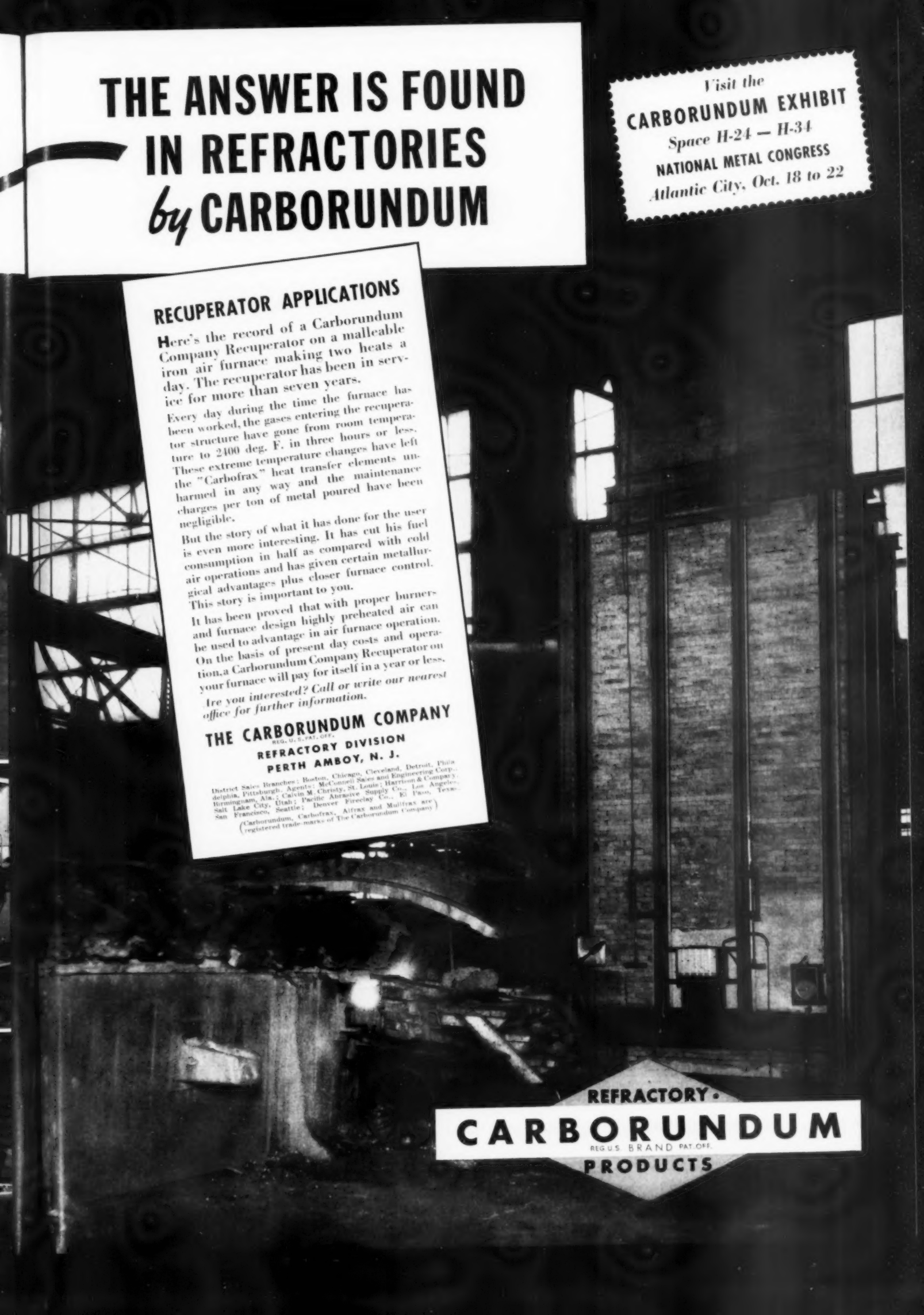
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(*Concluded from page* 74)
cated higher cost for equipment, fuel, refractories, although duplexing tends to cut this down; limitation on charge, dearth of good melters; and oxidation. However, if properly handled the disadvantage of oxidation may be turned to an advantage. Mr. Schneidewind discussed at some length results on work which has been done during the past year with electric furnace irons.

The final presentation of the afternoon program was entitled "Fundamental Structures of Gray Iron," with Alfred Boyles, metallurgist, Battelle Memorial institute, as discussion leader. Mr. Boyles discussed with the aid of slides the structure which is developed upon solidification as the metal passes from the liquidus to the solidus.

Clyde E. Williams, director, Battelle Memorial institute, presided at the dinner Friday evening at the Deshler-Wallick hotel. Brief talks were made by Dean Charles E. MacQuigg, Ohio State university; John Howe Hall, consulting engineer, High Bridge, N. J.; Robert E. Kennedy, technical secretary, American Foundrymen's association, Chicago, and Frank G. Steinebach, editor, THE FOUNDRY, Cleveland. C. H. Lorig of Battelle, who arranged for the various programs and sessions of the conference, also was introduced.

Reader's Comment

EDITOR'S NOTE—*Material Appearing Under this Head Does Not Necessarily Reflect the Opinion of The Foundry or of Its Editors.*

Too Big

TO THE EDITORS:

I was very pleased to look over the article which you have published in the September issue of THE FOUNDRY which is an abstract of the paper I presented at the Regional Foundry conference held here on April 9 and 10.

I note that in the second paragraph you refer to the value of *E* for cast iron as varying from 60,000,000 to 100,000,000 pounds per square inch. This is obviously an error since my original manuscript shows 6,000,000 to 10,000,000 pounds per square inch.

I will be pleased if you will make some corrections in a future issue, if at all possible.

JOHN M. LESSELS
Massachusetts Institute of Technology
Cambridge, Mass.

Iodine Number

TO THE EDITORS:

We have read with considerable interest the article appearing in the September issue of THE FOUNDRY by R. E. Aptekar of the American Brake Shoe & Foundry Co., New York.

In Table III—Physical Properties of Core Oils—the information is not correct, and we are very certain that the article will be misleading to a number of foundrymen, who have been given the correct information by ourselves as well as by other core oil manufacturers.

In this table the iodine number of linseed oil is given as 175-202. It is, of course, possible to secure linseed oil having an iodine number of 202 as given in this table, but this would be a very special grade of linseed oil and we question if it can be procured from any of the American manufacturers. In the same table perilla oil is shown as a semidrying oil although this oil is a better drying oil than linseed oil and is so recognized by leading authorities. This table gives the iodine number of perilla oil as 163-165 although on the Wijs method it will have an iodine number of 202-208. Most of the other information given in the table is approximately correct, although it has evidently been taken from reference books which are not up-to-date.

D. S. HOPPING
President
Dayton Oil Co.,
Dayton, O.

Issues Supplement To Standards

The American Society for Testing Materials, 260 South Broad street, Philadelphia, recently has published its 1937 *Supplement to the Book of A. S. T. M. Standards.* The supplement contains 272 pages and lists 44 standards adopted or revised by letter ballot of the society on Sept. 1, 1937. Eighteen of the standards are new, and the remaining 26 are replacements of existing standards. In addition the book contains a sheet of stickers to be attached to the appropriate page of the 1936 *Book of A. S. T. M. Standards.*

Bulky materials which are handled by hand, should be tipped carefully to a balance and secure handholds obtained before any attempt is made to lift or to move.

Employ Small Size Cupola in Work

At the autumn meeting of the British Iron and Steel institute held Sept. 15 to 17 at Middlesbrough, Yorkshire, a paper entitled "Some Experiments in a Small-Scale Cupola," was contributed by H. E. Blayden, W. Noble and Prof. H. L. Riley, Newcastle-upon-Tyne. In this paper the performance of some commercial and experimental-oven cokes and several carbons (electrode and retort carbon, petroleum coke, carbonized anthracite) were compared under similar conditions, following their use in a small-scale experimental cupola with a shaft 9 inches in internal diameter and giving a melting rate of 220 to 250 pounds per hour of iron at about 1330 degrees Cent. (2425 degrees Fahr.).

It was found that the rate of combustion and of melting were affected markedly by the coke size and rate of air supply. Metal temperatures appeared to be more sensitive to variation in the coke size than to variation in the airblast above certain limits, which probably were fixed by the cupola dimensions and design. The use of highly-graphitized carbons in the cupola tended to the production of increased metal temperatures. The experiments suggest that differences in the performances of cokes under practical conditions are largely attributable to differences in the mechanical strength of the cokes.

Minerals Yearbook

United States department of interior, bureau of mines, recently has published *Minerals Yearbook*—1937 compiled under the supervision of H. H. Hughes, of the economics and statistics branch.

The publication is divided into three parts, the first being devoted to a survey of mineral industries, the second to metals, and the third to nonmetals. There are 120 ilustrations reproduced.

The volume may be obtained from the superintendent of documents, Washington, for $2.25 in cloth.

Largely because of the increasing shortage of skilled labor, there was an increase during 1936 of 114 per cent in the number of employes enrolled in apprenticeship and general employe training programs. This increase was actuated through cooperative arrangements made with the International Correspondence Schools, Scranton, Pa., by more than 2500 industrial concerns throughout the country.

ADVERTISING PAGES REMOVED

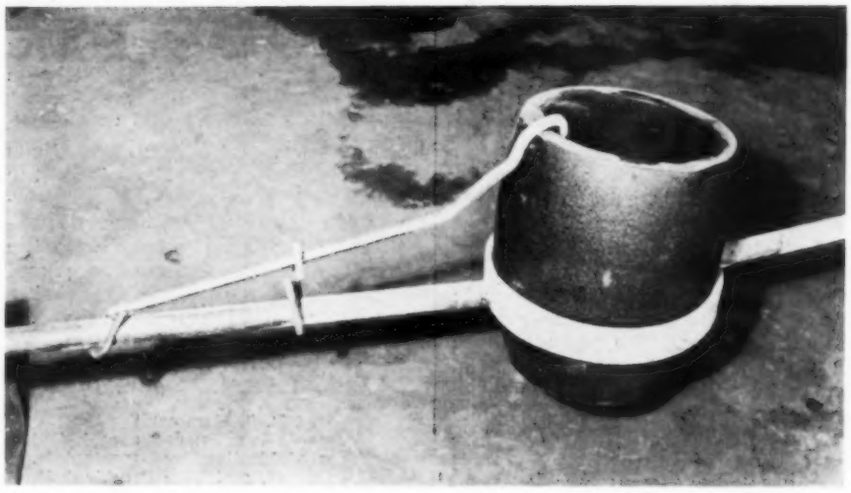


Fig. 6—Showing application of clamp for holding the pot in the shank

Need Skill in Foundry

(*Continued from page* 30)

The pattern plate, drag and cope of a mold for small centrifugal pump impeller castings, shown in Fig. 2, are representative of the equipment employed for making nearly all the castings. The pattern is an aluminum matchplate containing part of the pattern on the drag side and the remainder of the pattern on the cope side. Great care is taken in the construction and finishing of the patterns since the resulting castings are held to close tolerances in dimensions, weight and balance. This latter factor also must be considered in weighting the molds and pouring the metal. If the weight is insufficient, or if the metal is driven in too rapidly or from a considerable height, the pressure will lift the cope more or less and produce scrap castings.

Provide Generous Sprue

For this reason, as may be noted in the illustration, the mold is provided with a generous size sprue, runner and gates so that the mold cavities will be filled readily and rapidly. Experienced men pouring the metal *cut 'er short* at the proper moment and then fill the remainder of the sprue gently. Pouring metal properly requires a high degree of skill, only to be acquired through actual experience. In addition to coordination of hand and eye, the operation involves a nice and instinctive sense of time. Since each molder is more familiar than any other with his own molds it seems quite logical to find that each man pours the molds he has put up. A helper brings the crucible from the furnace and then manipulates the hoist while the molder on the double end of the shank pours the metal into the molds. A home made safety catch shown in Fig. 6, prevents the crucible slipping from the shank even when the crucible is at the lowest or horizontal position. The sliding link in the center is moved to the left to release the catch, or to the right to hold the crucible firmly in place. It is extremely simple and in common with many simple devices, extremely efficacious. Incidentally, it is claimed that the life of these crucibles melting red and yellow brass is approximately 150 heats.

Machines Close to Windows

Molding floors on both sides of the foundry extend only a comparatively short distance from the windows. The molding machines, jolt or squeeze type or a combination of both in some instances, made by the Tabor Mfg. Co., Philadelphia, are located close to the windows and the sand piles are cut up in the immediate vicinity. For convenience in many respects the molds are stacked two deep and since each man is supplied with metal several times each day, the number of molds on the floor at any given time does not exceed 25 to 30.

With this arrangement the operator has to carry his molds only a short distance from the machine. Since the lower tier of molds is poured first, the upper tier serves for weight, thus reducing by half the labor of shifting weights which have to be placed later on the upper tier. In like manner the work involved in shaking out the molds is reduced to a considerable extent. The molds are not shaken out indiscriminately all over the floor, but are carried to the back of the floor and in batches of 5 or 6 at a time are placed on edge on the stout wooden device, shown in Fig. 4. By bringing the flask down sharply the sand falls out while the castings remain on the supports. Bottom boards and flasks are piled in the vicinity of the molding machine. Castings are thrown in a pile to be picked up later and taken to the cleaning room and the sand is wet down and cut over in the direction of the molding station.

Flange Formed in Core

Combination of several factors, including the skill of the operator, is responsible for the production in large numbers of the ferrule castings shown in Fig. 7. These castings, which form the connecting link between the soil pipe line and various sanitary fixtures, are made in several lengths and diameters. In some instances the casting is a plain bushing with a light ring or flange at one end, as shown in the illustration. In others the casting is flanged at both ends. In the second instance the lower flange is formed by a dry

Fig. 7—Gating system is principal factor in securing good castings

sand ring core which is placed in a loose ring print that is removed when the sand in the drag has been rammed to the desired height. Otherwise the molding practice for both types is alike.

A fine grain, highly permeable sand from the Zanesville, O., district is employed in the molds for these castings. Moisture is held to about 5 per cent. Obviously the conditions are not so severe as they would be with heavy castings, but even with these light castings the density of the sand is an important factor. Hard ramming will produce scabs, blowholes and cold shuts. Soft ramming will produce swelled castings. Ideal density, whether the sand is rammed by hand or on a machine, only may be attained through actual experience. Incidentally it is interesting to note that some operators acquire skill, manual dexterity and an intangible sixth sense, much more rapidly than others.

In this, as in other jobs presenting peculiar or hazardous features, management has contributed its share toward elimination or more properly speaking prevention of scrap castings. The molds are made in stiff steel flasks that prevent the sand from sagging or yielding. Long, accurately fitted guide pins facilitate drawing the patterns from the sand. The pin holes are bushed and constantly inspected for any evidence of wear. Method of gating the castings, as fully illustrated in Fig. 7 probably is the most important single factor in the successful production of a comparatively large number of ferrules in one flask.

Although yellow brass at proper pouring temperature has excellent running qualities, still it is apparent that it is subjected to a severe test in filling so many mold cavities where the wall opening is approximately ⅛-inch. The metal is poured into a large sprue located near one end of the cope and therefore in convenient position for the lip of the crucible. A large central runner in the cope feeds a series of three gates on each casting. The gates also are in the cope and extend over the top flange instead of being cut into the flange at the joint. In this manner the metal drops directly into the mold cavity in three streams and does not impinge on the wall of the core.

Equipment Makers Meet in Fall

A Fall meeting of all manufacturers of foundry equipment will be held at the Greenbrier hotel, White Sulphur Springs, West Va., on Oct. 18 and 19, according to an announcement by Arthur J. Tuscany, executive secretary, Foundry Equipment Manufacturers association, Penton building, Cleveland. Mr. Tuscany directs particular attention to the fact that all manufacturers of foundry equipment are welcome to the meeting whether they are members of the association or not. During the same days the Steel Founders society will meet at nearby Homestead hotel, Hot Springs, Va., and the Conveyor association will be in session at White Sulphur Springs.

The equipment meeting will consider present business conditions and prospects for the future, the results of a recently released survey of wage and employment conditions in the industry, and also the results of a comparison of sales and administrative expense now being completed. The tentatively arranged program is as follows:

Monday, October 18

9:30 a. m.—CALL TO ORDER

President R. S. Hammond

Statements on Purposes and Objectives of Meeting, by President R. S. Hammond, and Vice President H. S. Hersey.

"The Background of Wage and Hour Legislation," by Arthur J. Tuscany.

Report on and Consideration of Results of Wage and Hour Survey in Foundry Equipment Industry.

Consideration of the following: Wage Rates for various classifications of employment; Policy or Activity to increase supply of skilled labor; Status of Labor Union Activities and experience of individual companies.

Consideration of Business Conditions and Prospects.

Report of Industry Directory Committee Chairman O. A. Pfaff.

Credit Interchange Service, by Chairman O. C. Sabin.

1:00 p. m.—LUNCHEON

2:00 p. m.—GOLF TOURNAMENT

6:30 p. m.—INFORMAL DINNER

Toastmaster R. S. Hammond,

Statistical Committee.
Chairman Thos. Kaveny, Jr.

Monthly Statistics.
Comparisons Administrative Costs, with particular reference to Selling Costs.

Membership Committee.
Chairman C. B. Schneible.

Statement on Aims and Purposes of Policy of Policy Committee.
Chairman R. S. Hammond.

Tuesday, October 19

9:00 a. m.—MEETING OF PRODUCT GROUPS

12:30 p. m.—GROUP LUNCHEON

Presentation of Pictures and Description of—"Foundries Around The World", by W. F. Piper—Beardsley & Piper Co., Chicago.

2:00 p. m.—MEETING OF BOARD OF DIRECTORS

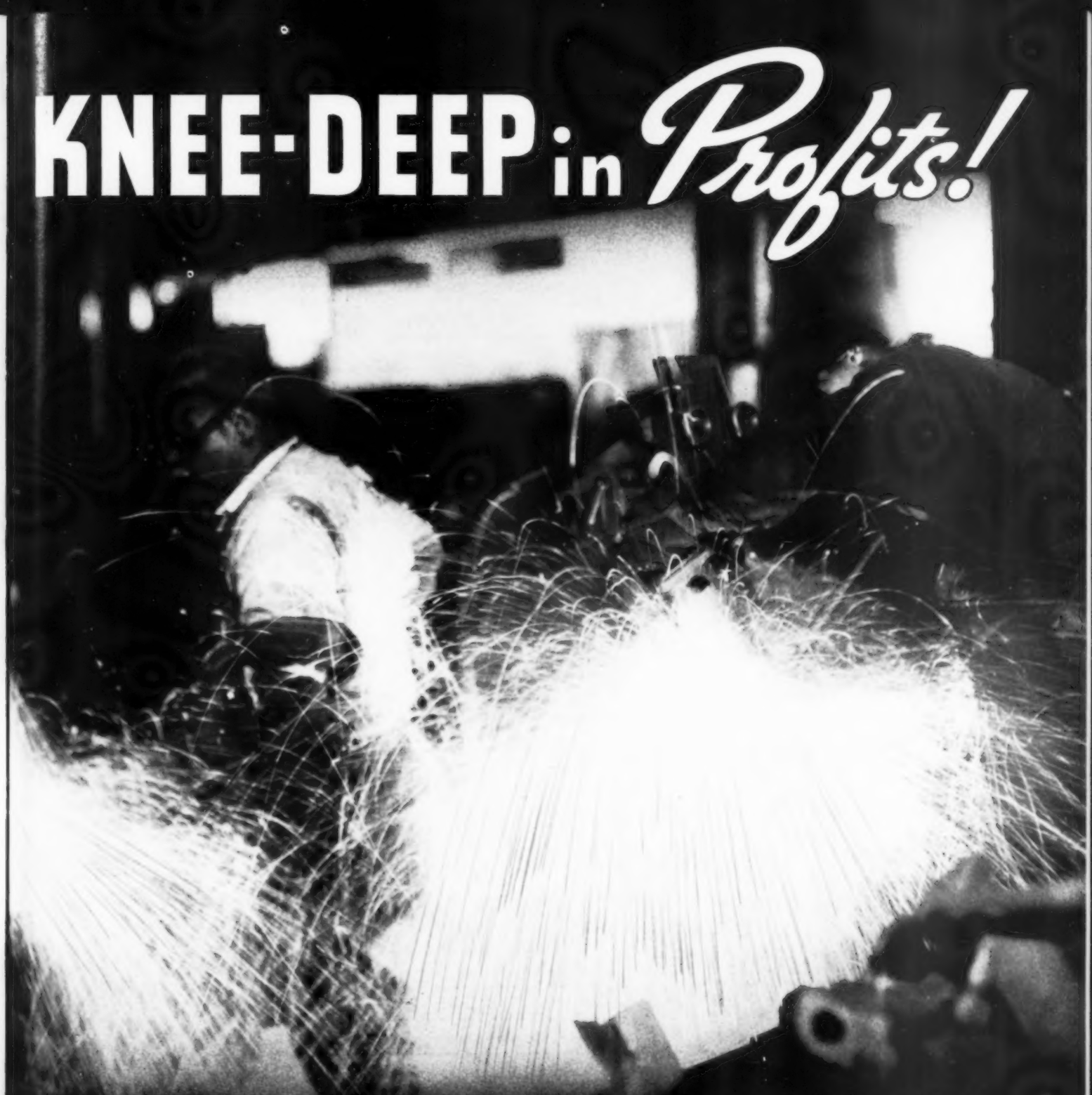
Officials at Opening of Congress

PHOTOGRAPH of officials seated on the platform at the opening meeting of the recent International Foundry congress in Paris. From left to right: Mr. Damour, past president of the French association and of the International committee; Mr. Oliver, president of the Syndicate de Fondeurs de France; V. Delport, President, International committee and European manager of THE FOUNDRY; *Mr. Julien, Minister of Technical Education; A. Brizon, President, French Founders association; Mr. Luc, Director of Technical Education; Prof. A. Portevin*

Discusses Dust

United States department of the interior, bureau of mines, recently has published bulletin 400 on "Review of Literature on Effects of Breathing Dusts with Special Reference to Silicosis." The text includes information on the physiological effects of breathing dust, types of dust injurious to health, prevention of dust diseases, engineering control in prevention of diseases, medical control and general recommendations for the control of dust diseases in industry. The publication may be secured from the superintendent of documents, Washington, for 25 cents.

KNEE-DEEP in *Profits!*



IN THE FOUNDRY...sparks are profits! These tough, high-speed U. S. ROYALITE WHEELS are snagging 200,000,000 chips a minute . . . eating up dead metal...taking a big bite out of operating expense . . . cutting down costly time! High-speed U. S. ROYALITE GRINDING WHEELS are strong, fast, and safe! They run cool and last long... that's why they give you—

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United States Rubber Products, Inc., New York, N. Y.

Good Core Making

(*Concluded from page* 36)

film formed by cereal or oil in baking. Cereal film is formed by precipitation of cereal from concentrated solution, while the film of the oil is the result of shrinkage and polymerization of oil. Thickness of film is, of course, proportionate to amount of binder per unit area of sand grain. Its strength is proportionate to intrinsic strength of film forming oil and number and area of contacts between grains. Thus, highly viscous oils tend to have the thickest film, and sands of wide grain distribution and high angularity, the greatest surface contact area and therefore strength. Resilience of film largely is a matter of proper temperature and time control in baking. The higher the temperature above 400 degrees Fahr. the more readily this film resilience is destroyed with linseed oil, and the lower the residual strength. With cereals, the best temperature is about 500 degrees Fahr. and their film strength is more sensitive to over baking than is the case with oils. Fig. 7 illustrates types of film structure.

Core Distortion Occurs

Distortion of a core occurs during baking if type of binder is such that it quickly forms a surface film over the oil film in the body of the core, preventing proper drying of under layers. When sufficient temperatures are reached to distill a portion of the body of this film, bubbling of the film occurs, expanding the core body. Some oils, particularly those having low iodine value, do not form such a surface layer rapidly enough, and with increasing temperature the viscosity of the oil decreases rapidly causing the core to sag of its own weight.

The only property of a core capable of quick practical measurement, is its ultimate strength, although that property is the result of other properties previously described. This ordinarily is measured in pounds per square inch required to break a 1-inch square specimen in transverse at the center of an 8-inch bar supported on 6-inch centers. This strength is taken on the core after it has been baked and cooled to room temperature, and varies in workable cores from 6 to 70 pounds per square inch. Most of the satisfactory core mixes are in the range of 25 to 50 pounds per square inch but this requirement varies with the purpose and design of the core.

Since cores are made to go into molds eventually, their properties, as affecting their mold behavior, are of interest. These properties are ultimate strength, moisture absorption on storage and in the mold, permeability, residual gas content, refractoriness and finish, and break down under heat.

Ultimate strength and behavior of cores were discussed previously. Of almost equal importance to these properties is moisture absorption rate of core mixes on storage in the foundry and mold. It generally is conceded that when the core has absorbed a certain amount of moisture, its strength decreases proportionately with its absorption rate. Linseed oil cores, properly baked, absorb but very little moisture on storage and only 6 to 7 per cent moisture in the mold, but this absorption is sufficient to reduce by some 15 per cent the strength of even this type of core. Cereal mix cores have a much higher rate of moisture absorption; those cores made entirely of cereals absorbing rapidly sufficient moisture to cause their complete break down under little stress. Even on storage, mixtures of cereal and oil tend to depreciate rapidly.

Permeability Is Measure

Permeability of the core is a good measure of the probable expected finish that may be produced by that core, the lower permeability giving the better finish. All cores in practice are vented to the outside and sufficiently large channels for the gases are provided to make egress of gases easy.

In steel castings and in large gray iron castings, refractoriness of a core is of high importance inasmuch as most cores are almost surrounded by metal. Core sand mixtures must have sufficient refractoriness not to fuse into the metal. Refractoriness of cores is governed by purity of its sand and by its structure. In general, in two sands of equal purity, the finer and more angular sand will fuse and show penetration less readily than the coarser, rounded grain material.

While a core must be strong enough to resist mechanical pressure of metal and its thermal shock, it must have the ability to disintegrate after the casting has solidified to allow for a minimum of interference to the free contraction of the metal and to make removal of the core easy. Both oil and cereal mixes in general, fulfill these requirements very well; the clay and pitch cores, on the other hand, are difficult to remove.

In the rapid progress recently made in core making practice, there is the promise of much further future improvement in many ways.

Materials of core making are undergoing rapid development. As indicated, oils have been materially improved and the oil of the future is likely to be a partially oxidized and polymerized material containing metal oxides which will make it possible to bake cores without the presence of atmospheric oxygen, probably in a much shorter time than now is the case. Contributing to this development undoubtedly will be vacuum sealed ovens, recirculating and conserving waste heat.

Much more careful grading and blending of sands is in the immediate offing, being already a partially accomplished fact. Of interest in this direction of speculation, are recent tests that have been made by an eastern firm using a calcined, ground and sized, refractory grain base for cores. Such a material has the advantage of no expansion and contraction under heat and is reputed to give higher strengths with better oil ratios. Similarly, in an eastern steel foundry, they have in the past 2 years brought to this country from France the practice of cement bond molding, and core sands, and in this type of practice greater accuracy to pattern is claimed, with better finish.

For binders other than oil, resinoid, rubber, and hydrated cements already have been mentioned as future possibilities.

Therefore it is not difficult to foresee in the immediate future an even greater development and improvement in core practice than has been the case in the last progressive 10 years. In that development, we, who are in the industry, can usefully and proudly bear a part.

Iron Insulators

Over 500,000 malleable iron insulator caps for wire suspension insulators are being used in the electrification of the main line of the Pennsylvania railroad from Paoli to Harrisburg, Pa. The caps separate the strings of porcelain insulators and are subjected to severe conditions requiring high corrosion resisting qualities and strength. They are made to withstand an ultimate load of 25,000 pounds per square inch.

Century Silica Co. has opened an office at 1220 Park building, Pittsburgh, in charge of Albert Frederick, sales manager. Nearing completion at Foxburg, Pa., are the company's crushing, grinding and preparation facilities. Operations are expected to begin in the near future. E. Frank Wilson is vice president of the company.

At the Right — Type PKT Jolt, Squeeze, Strip Machine, molding Brake Drums

Below—Type F Jolt, Power Turnover, Power Draw Machine, molding large Fittings

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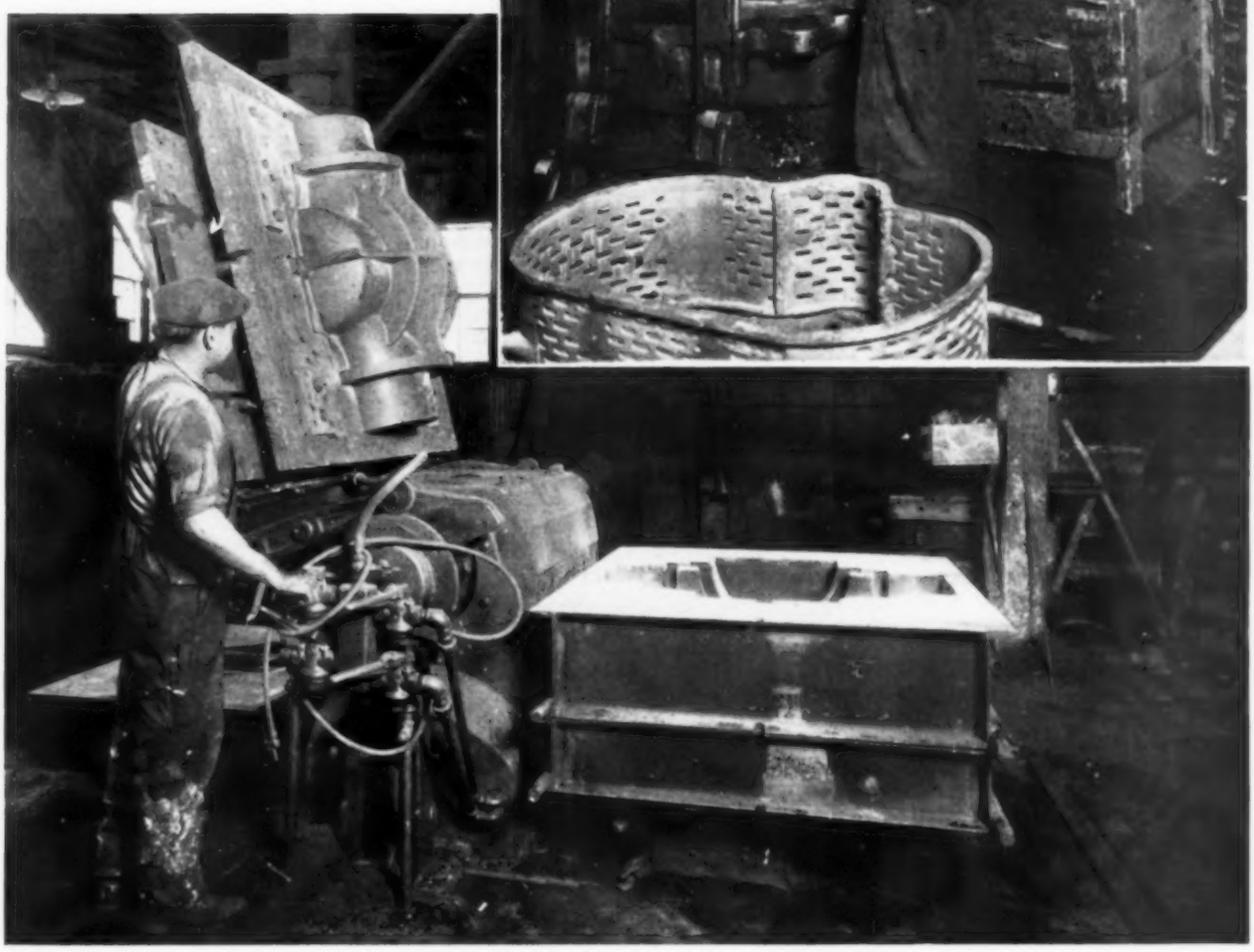


The **INTERNATIONAL** Line consists of
65 Standard Types of machines for Castings
14 Standard Types of machines for Cores, including 4 designs of BLOWERS
Many Special types of machines for work of unusual character

INTERNATIONAL MOLDING MACHINE CO.
2608-2624 W. 16th St. **Chicago, Illinois**

Handles Materials Efficiently

(*Concluded from page* 37)

carry the coal to the furnaces. Similar tractors with platform bodies transport pig iron and other materials into the foundry.

Orders for castings start at the pattern storage department, shown at the extreme upper left in Fig. 2. This is a completely fireproof building equipped with a sprinkler system and metal shelves for storage of the patterns. In the pattern storage card index system each card has a sketch of the pattern on it. The pattern shop, where wood and metal patterns are made, is located close to the pattern storage department. One end is partitioned off for a brass foundry in which brass and aluminum patterns and aluminum match plates are made.

Owns Sand Bank

The company owns its own sand banks within short hauling distance of the plant. A good grade of core sand is brought in by truck and stored in the cellar of the core department. It is delivered to the sand mixing machines on the floor above by a bucket elevator. Most of the cores are made in quantity on the core blowing machines. Some hand work is necessary in a jobbing shop where various types of castings are ordered in small quantity.

Cores are dried in a battery of drawer and rack type oil fired core ovens laid out in a rather long line which necessitates a correspondingly long firing tunnel. One of the recent modernizing steps has been to line this tunnel with carborundum brick. Due to the great heat conductivity of this material the efficiency of the core ovens has been increased. Cores are transported to the foundry in specially constructed rubber tired buggies.

As shown in Fig. 2 the work progresses in a straight line from the pattern and core shops to the foundry buildings. Storage space for flasks and bottom boards is located conveniently between the pattern and foundry buildings. The melting furnace No. 1 and also in No. 2 foundry is located in the center of the building. The molding machines are arranged near the side walls where plenty of light is available from the windows. An aisle 5 feet wide always is kept clear in the center of the floor for the passage of trucktractors and for the pouring operations. Metal for the heavier castings is poured from an overhead monorail system operating over the floor at one side of the furnace. Unit heaters in No. 1 foundry blow hot air downward and prevent condensation and the formation of fog. Iron in this foundry is melted in a 35-ton, powdered fuel, air furnace, equipped with an individual pulverizer in which a special attachment regulates the fineness of the coal.

No. 2 foundry modern steel, concrete and brick construction, has a pond truss type roof and is well lighted and ventilated. A 30-ton air furnace is served by an individual fuel pulverizer similar to that in No. 1 foundry.

Both foundries have direct access to the hard cleaning department, into which the castings are moved on trucks. From the time the castings are shaken out of the sand until they reach the shipping room they travel for the most part on wheels, and usually on specially constructed trucks.

Hard Cleaning Department

The hard cleaning department is equipped with rotary sandblasting machines, a sandblast room, and six elevated tumbling mills which operate individually. Trucks, which afterward are used as inspection benches, are pushed under the elevated barrels and the cleaned castings are dumped directly into them.

The loaded trucks are wheeled into the next department where the castings are trimmed and inspected. First the trucks are wheeled to places in front of the windows where the light is good. The castings which pass inspection are trimmed on the grinding machines, individually operated and lighted, and connected to dust collection lines.

During the annealing process special efforts are made to prevent decarbonization and to insure a metal suitable for rapid threading. The ovens with individual damper control are insulated on the top, bottom and sides. Each of the 5 ovens has a capacity of from 30 to 35 tons. A pyrometer system registers the temperatures. It consists of a platinum and also a base metal system and a six color recording instrument. Temperature reading of any furnace is facilitated by a rotary switch and single pivot wall-mounted galvanometer.

Stacks of annealing pots are placed in the ovens by a charging machine, and are removed by the same machine when the annealing cycle has been completed. The castings then are loaded into large tote boxes which are taken by an overhead traveling crane to the sandblast or tumbling barrels of the soft cleaning department, located at one side of the annealing department, and in line with the shipping department.

The soft cleaning department is equipped similarly to the hard cleaning department. Here again the castings discharged from the sandblasting machines and tumbling barrels move on wheels into the shipping department. At this point they are dumped into bins of the proper height for sorting and further inspection. The sorted castings are placed in tote boxes behind the sorters and are moved on gravity roller conveyors to a weighing station, and from this point into bags or barrels for shipment.

As shown in Fig. 2 the shipping department is next to the railroad siding over which the raw materials come into the plant. They make a complete circuit without any crossing of the lines of travel.

Fitting castings are sent to the machine shop located in a room adjacent to the shipping department and also on the floor immediately above. Here the tapping and threading operations are completed which make the castings into fittings. Fittings designed for high pressures are tested individually, and representative tests are given the standard malleable fittings in special testing machines built by the company.

Operation Is Efficient

From the foregoing brief description it is apparent that the plant has been laid out carefully for efficient operation, and that mechanical handling plays an important part. The metallurgical department exercises careful technical control of the melting and annealing, and is directly responsible for the quality of the metal.

All departments are kept in a clean and orderly condition. It is all a part of the systematic manner of production, which, with the cooperative spirit of foremen and management, undoubtedly accounts in large measure for the fact that this foundry, although old in years, is among the active up-to-date plants of the period.

Is Representative

Hammond Machinery Builders Inc., Kalamazoo, Mich., has appointed C. D. Hollins, 2132 Morse avenue, Chicago, and C. P. Guion, 1661 Milwaukee avenue, Chicago, as representatives in Wisconsin, Illinois, Iowa, and Indiana.

The company also has appointed the B. & H. Sales Co., 4980 Potomac street, St. Louis, as representative in the St. Louis district.

Chicago Pneumatic Tool Co., 6 East Forty-fourth street, New York, has opened a factory sales and service branch at 119 West Second street, Salt Lake City, Utah. Otto A. Ray is manager of the branch.

ADVERTISING PAGES REMOVED

FOREMANS HEAT SHEET Date			
FLOOR NO.	NO. LADLES	WEIGHT	TOTAL
		PLUS %	
		TOTAL CHGS	

Fig. 7—Iron requirements of each molder are given on this card

Keep Track of Costs

(*Continued from page* 39)

several important operations are necessary. Status of the pig iron situation, as shown in Fig. 1, covers the following items: An individual card is made out for each car of iron. Each car of iron should be piled in a separate heap, the amount consumed daily recorded and a notation sent to the accounting department for pricing. Chemical analysis should be set down. One entry is charged off when the carload is consumed. Complete history of the car appears on the card including name of the furnace, chemical analysis, gross ton, freight rate per ton, total freight, unloading cost, total cost per pound.

A similar card shown in Fig. 2 carries a record of coke purchased and consumed. A card is made out for each car load of coke received. Each car load may be piled in a separate heap, although this is not so important with coke as with pig iron. The chemical analysis should be entered on the card. One entry is charged off daily, or whenever one car load is completely consumed. Additional information includes: Source of supply, total tons in car, freight rate per ton, total freight charge, unloading charge per ton and pound, total cost per pound. Similar record cards for fire brick, clay, sand, scrap, etc, readily may be designed to show daily cost of materials consumed.

Practically every industry of any size is divided into departments. Showing comparable running costs of each department as to efficiency and expense, often tells a very interesting story. Cost records that do not follow departmental compilation do not serve the purpose for which they are designed.

Departments in the foundry include: Melting, core making, molding, cleaning, inspection, grinding and trimming, finishing, shipping. Operations of each department and a method for finding and recording the costs will be presented briefly through forms used in the various departments.

The furnace or metal department may be classed as the most important in the foundry and the melting furnace is the heart of the department. Metal in the gray iron foundry is melted principally in the cupola, although a certain amount is melted in the air furnace, in the electric furnace and in the rotary type furnace.

Costs for the melting department are based on the cost of iron at the spout, therefore all necessary operations and expense must be charged as melting department expense. The list includes all expense of the ladle department, blacksmith shop, laboratory, iron, coke, wood, oil, flux, clay, firebrick, general repairs and depreciation on all equipment in the department.

In the daily routine the metallurgist prepares the daily heat or iron mixture sheets, shown in Fig. 3, based on the known chemical analysis of the materials in the yard. The card shows the amount of pig iron and scrap required for the day's heat. The various amounts are proportioned properly and arranged in sequence to yield iron of the desired analysis at various stages of the heat.

The foreman's daily requisition for the total amount of iron required is shown on Fig. 7 and this in turn is based on the anticipated number of ladles required on each floor. The iron mixture card Fig. 3 is handed to the cupola and the yard foreman With the car number in evidence on each pile, he directs the labor crew on how much of each pile of iron is to be taken to the cupola for the day's heat.

The card, shown in Fig. 7, is made up by the foreman or superintendent just before melting time. Usually he goes to each molder's floor and receives their iron requirements in terms of so many ladles. Knowing the capacity of the ladles he totals the amount of iron required and adds a known amount for furnace loss, unforeseen contingencies and over iron. The completed record of the number of

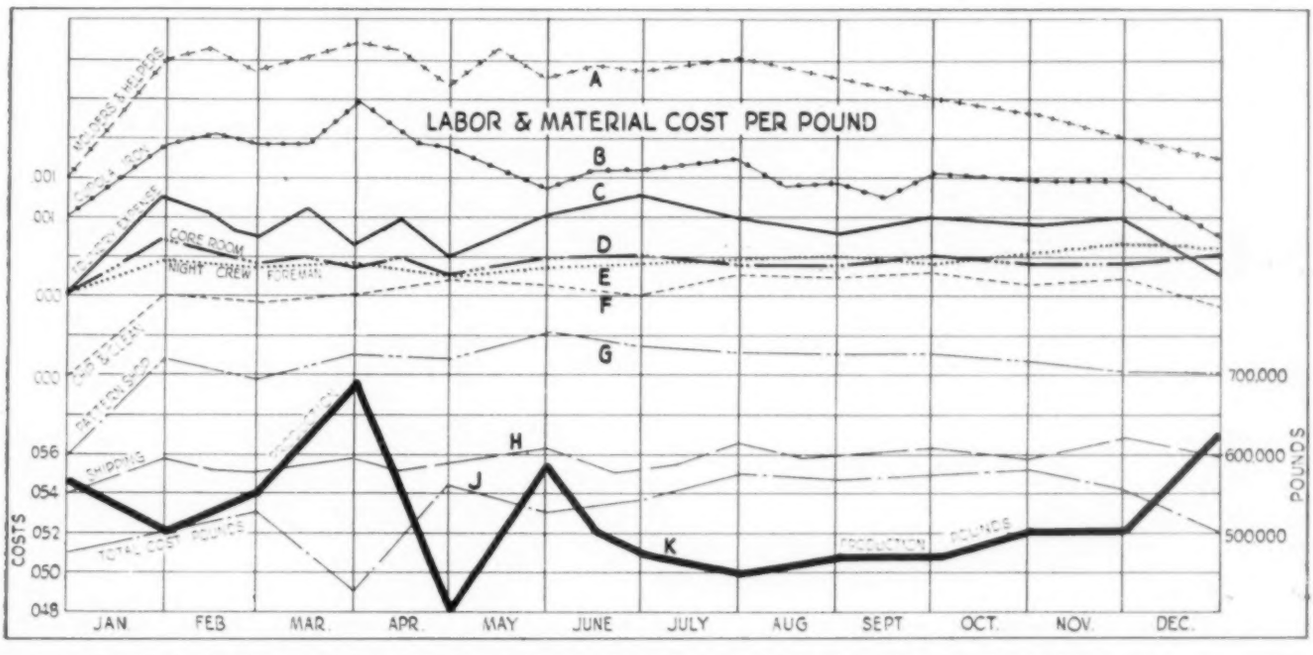


Fig. 8—Use of charts similar to this containing information on various phases of foundry production show to the busy executive just what is taking place

charges required is given to the foreman in charge of the melting department. This record shows the foreman of the melting department how many charges of the various mixtures are needed for the heat.

With everything in readiness the cupola is placed in blast at a given time determined by the total amount of iron to be melted, or in other words on the rated capacity of the cupola in tons melted per hour. Complete history of the day's heat is made on the card shown in Fig. 4. This is made up by the yard foreman and is forwarded to the accounting department for pricing. Fig. 5 shows the completed record of the daily heat. Usually this is intended for the superintendent or plant manager and gives him complete information at a glance; total amount of pig iron and total amount of foreign and home scrap, total amount of metal charged less the returned scrap, also the total amount of castings to be accounted for. The record also shows total amount of coke consumed, furnace loss, coke used per ton of metal melted, time the wind went on and off and the amount of iron melted per hour. The report shown in Fig. 6 usually is all that is needed by the president of a large foundry to give him a clear picture of the daily molder production.

Another means of showing the busy executive what is taking place in the foundry is by developing a curve similar to that shown in Fig 8 over a period of a year. Line *A* shows the cost of molder's and helper's labor; *B* is the cost per pound of iron melted in the cupola; *C* is foundry general expense; *D* is the cost per pound for cores; *E* is night shakeout labor cost; *F* is the cost per pound for cleaning and chipping; *G* is the cost per pound for pattern work; *H* is the cost per pound for shipping; *J* is the total cost per pound including all the foregoing factors; *K* is the total production in pounds.

Tendency of these curves should be toward a straight line. The straighter the lines can be drawn from the monthly cost, the more real control the plant will have over its expense. A curve that fluctuates to an abnormal extent indicates inefficient supervision and control of costs. The higher the production curve can go and the straighter the expense curves can be drawn, the more ideal the cost control will be. Curves that show a cost control without much deviation indicates a greater opportunity to show a margin of profit. Curves can be plotted on large boards and records kept daily. Daily plotting of curves for labor production and expense tell a very interesting story to the busy executive.

OBITUARY

EDGAR A. CUSTER, 76, prominent in the industrial life of Philadelphia for the past 40 years, died in that city Sept. 25, a few months after publication of an interesting autobiography *No Royal Road*. He was born in Altoona shortly before the Civil War and as a boy entered the railroad shops of the Pennsylvania railroad. Later as a mechanical engineer he followed railroading in various parts of the country and for many years was connected with the Baldwin Locomotive Works in Philadelphia. In the early 1900's he operated the plant of the Tacony Iron & Metal Co., and while there developed and installed what probably was the first successful permanent mold equipment in this country devoted to the production of soil pipe and fittings. An exceedingly vigorous, ingenious and resourceful foundryman he played a prominent part in the foundry industry.

♦ ♦ ♦

Gust Erickson, a partner in the Arrow Pattern & Foundry Co., Chicago, died recently at his home in that city.

♦ ♦ ♦

John C. Briggs, 50, metallurgist at Denver for the Gardner-Denver Co. of Quincy, Ill., died in Denver recently. Mr. Briggs was a native of Fairhaven, Mass.

♦ ♦ ♦

Gustav A. Bingenheimer, 70, president and general manager of the Diamond Iron Works, Minneapolis, until his retirement a year ago, and since that time acting chairman of the board, died recently in that city.

♦ ♦ ♦

J. Bayard Hearn, 57, assistant to the president, Lobdell Car Wheel Co., Wilmington, Del., died Sept. 22 at his home in that city. He was born in Crisfield, Md. and had been associated with that company for 40 years.

♦ ♦ ♦

Robert B. Haskins, 69, who retired 9 years ago as engineer for the Hill & Griffith Co., Cincinnati, died Sept. 7, at his home in that city. Mr. Haskins also was an inventor and manufacturer of foundry chaplets.

♦ ♦ ♦

Clarence R. Falk, 67, secretary-treasurer, Falk Corp., Milwaukee, died Sept. 29 in that city. Mr. Falk was a member of a pioneer Milwaukee family and was interested in many types of civic advancements. During the war he was connected with the ordnance department in Washington. A brother, Otto H. Falk, is chairman of the board of the Allis-Chalmers Mfg. Co., Milwaukee. Mr. Falk was a former president and director of the National Metal Trades association.

♦ ♦ ♦

Charles McNellis, 46, secretary of the Imperial Brass Mfg. Co., Chicago, died in the Garfield Park Community hospital on Aug. 17. Mr. McNellis was born in Chicago and had been connected with the Imperial organization for 31 years.

♦ ♦ ♦

Whitfield Clark, vice president of the Kilby Car & Foundry Co., Anniston, Ala., died recently of a heart attack. He was president of the M. & H. Valve & Fittings Co. and was connected with other business enterprises in Anniston.

♦ ♦ ♦

August S. Evers, 81, retired owner of the Western Iron Foundry Co., Denver, died recently in that city. Mr. Evers was born in Germany and came to this country when a young man. He lived in Cleveland for a number of years before going to Denver in 1889.

♦ ♦ ♦

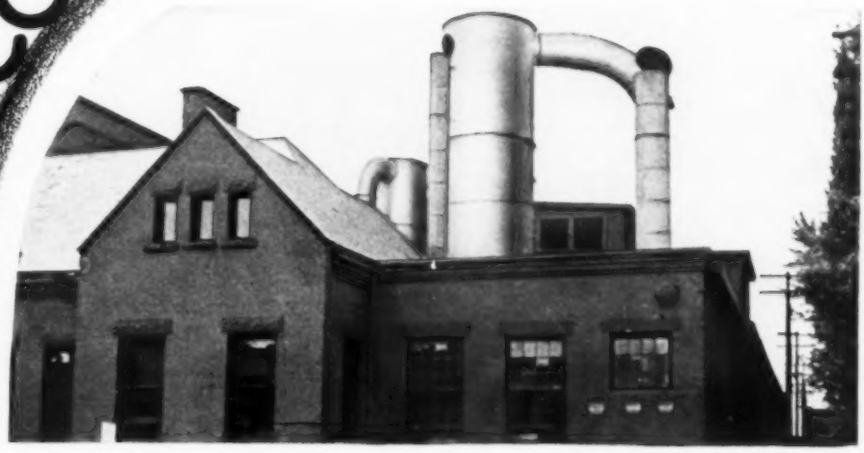
John C. Kahl, 57, manager of the Vandergrift, Pa., plant of United Engineering & Foundry Co., Pittsburgh, died Sept. 21 in a hospital after a long illness. He had been on a leave of absence from the plant since last May. Mr. Kahl was born in Sharon, Pa., and had been manager of the Vandergrift plant for 21 years.

♦ ♦ ♦

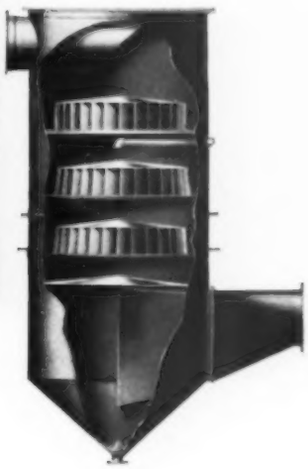
C. L. Hippensteel, 40, Morristown, N. J., member of the technical staff of Bell Telephone laboratories, New York city, died Sept. 20, in the Mountainside hospital, Montclair, N. J., after a long illness. For the past 16 years he had been engaged in chemical research on the atmospheric corrosion of protective metal coatings on iron and steel and on the mechanical testing of rubber installation. He was graduated from Purdue university in 1931, and was a member of the American Society for Testing Materials, the American Chemical society, and the American Electro Chemical society.

American Iron & Steel institute, New York, recently has published section I of a projected *Steel Products Manual* which presents definitions of pig iron and ferroalloys. The pamphlet contains 14 pages, and describes the various grades or classes of pig iron, and types of ferroalloys. Information on the usual range of composition is given also on each. Copies of the pamphlet may be obtained for 15 cents each.

THE ECONOMICAL METHOD—
The Multi-Wash Method



A recent installation showing two Multi-Wash Collectors on the roof of a large Eastern production foundry.



The Schneible Multi-Wash Method of dust and fume suppression is the most economical because it does not involve the use of filters, grids, screens, dust traps or any cloth, fabric, or material that requires replacement, cleaning or repairing. Yet it suppresses dust and fumes quickly and completely because the contaminated air drawn upward over the six impingement plates in the Multi-Wash Tower is washed thirteen times by a turbulent water spray, the washed air passing out at the top and the dust-laden water dropping down to the sludge cone and out through the sludge outlet from where it is pumped by Schneible "Wear-Proof" Sludge Pumps to a Multi-Louver Dewatering Tank; the water being recirculated for additional air-washing cycles.

The Schneible Multi-Wash Method is a fast, simple, labor-free dust suppressing process as natural as outside air washed by rain!

Other advantages in the operation of Multi-Wash Collectors are: (1) no internal moving parts; (2) nothing to rapidly wear, burn or break; (3) unaffected by heat or cold; (4) they occupy a minimum of space; (5) no nozzles or spray heads to clog—non-freezing.

Send for Catalog No. 10 showing a wide range of installations with complete engineering data.

Now! The Junior Schneible Multi-Wash Wet Dust Collector

Possessing the same major operating advantages as the larger Schneible Wet Method Dust Collector, the new Junior Model has been designed primarily for small foundries, isolated foundry operations, and single function operations such as mold shake-out, mulling, grinding, blast-cleaning and sand conditioning.

As in the larger Multi-Wash System, the Junior has no moving parts, no nozzles, nothing to burn, break or rapidly wear; nothing to clog, freeze, adjust, lubricate or maintain.

It can readily be converted into a Senior Model by the simple addition of a center impingement plate section to the tower.

The Schneible Junior Multi-Wash Collector fits into many installations where a Senior Model would be too large or too expensive.

Write for bulletin describing the New Junior Schneible Multi-Wash Dust Collector.

CLAUDE B. SCHNEIBLE CO.
DUST SUPPRESSION ENGINEERS
3951 LAWRENCE AVE., CHICAGO . . . . *Offices in principal cities*

Automotive Malleable Castings

(*Concluded from page* 34)

The cupolas melt about 25 tons per hour, and are in operation 16 hours or two shifts per day. Each cupola is equipped with a forehearth which holds about 10 tons of iron. Metal charges are composed of about 10 to 12 per cent high silicon pig iron containing 10 per cent silicon, 38 to 40 per cent steel scrap in the form of rails and baled sheet scrap, remainder hard iron sprue. The charges are 10,000 pounds and between 1100 to 1250 pounds of coke is placed between charges.

Coke is elevated to the charging platform by a skip which discharges into a storage hopper. From there it is weighed into steel buggies, and then goes into the cupola. Pig iron, steel, and scrap are brought to the charging platform by a magnet attached to a 10-ton crane. Those materials are weighed onto steel trucks by the charging crew. At the present time charging is performed by hand, but plans will be completed shortly for the installation of mechanical charging devices.

Temperature Is High

Iron is tapped from the cupola at an average temperature of 2800 degrees Fahr., and discharges into the previously mentioned forehearth where it is treated with fused sodium carbonate for desulphurization. Sulphur content of the iron leaving the cupola is around 0.100 per cent while that of the iron leaving the forehearth runs approximately 0.080 per cent.

Additions of soda ash are made by throwing the pigs in the spout as the metal flows from the cupola. Approximately 6 pounds of soda ash per ton of iron is added, and the slag formed is allowed to remain on the metal from 1 to 1½ hours before it is skimmed off. Regular cupola slag flowing continuously from the slag spout falls into a tank of flowing water which causes granulation.

As shown in Fig. 12 hot metal is taken from the forehearth in 3-ton ladles and transferred to one or the other of the two electric furnaces. As may be observed the transfer ladles are covered to conserve the heat. The transfer ladle carries the iron around to the backs of the electric furnace where it is dumped in.

The electric furnaces, while rated at 3-ton melting rate hold, approximately 11 tons of molten metal. Of that amount only 3 tons is poured out leaving a bath of about 8 tons.

Fig. 13—At the shakeout, the molds are pushed off the conveyor tables with a pneumatic ram on to a rapidly vibrating shakeout screen

Then 3 tons of the somewhat colder metal from the cupola is dumped in. Following that about 5 per cent steel scrap in the form of bundled sheet is added and the whole raised to a temperature around 2850 degrees Fahr. That usually takes about 4 minutes, and then the iron is ready to be poured into transfer ladles bound for the pouring stations.

Iron from the cupola is analyzed every 20 minutes, and from the electric furnace about every 1½ hours. While the metal on which the analysis is obtained is poured into castings some time before the determinations for the various elements can be completed, that routine enables a close control to be made on the raw materials entering, and on the melting operation. In addition a close check is maintained upon temperatures of the metal in both cupola and electric furnace.

Book Review

No Royal Road; by Edgar A. Custer; cloth; 428 pages 5½ x 8½ inches; published by H. C. Kinsey & Co., Inc., New York, and supplied through THE FOUNDRY for $3.50.

Here is a book typically American in incident and treatment, the life story of a man, mechanical engineer by profession, musician and artist for the fun of it. The book is full flavored with the charm of the author's personality, rich in humorous recollection of the era in which he lived. Now well beyond the traditional three score years and ten he sets down in delightful fashion experiences with incidents, people and events in a full lived, extensively traveled and vigorous career. Dramatic experiences with wrecks and riots in the turbulent seventies, long trips around the country testing new locomotives, drawing political cartoons for a newspaper and discovering the fascination of all-night poker games.

Railroad men, inventors, musicians, politicians and labor leaders pass in review as his memory travels over the years, picking up colorful events like a searchlight sweeping th country side. He presents interesting side lights on widely separated subjects; steel mills during the war, South American revolutionists, a trans-Andean motor trip from Chile to Argentina, Mexico and the American Southwest; running a foundry for several years where he developed permanent molds for the production of soil pipe and fittings; and his experience on the platform as a speaker at conventions of the American Foundrymen's association.

A foreword by Samuel M. Vauclain, chairman of the board, Baldwin Locomotive Works, intimate friend and industrial chief at various periods of the author's career, is done in excellent style and constitutes an inviting front door through which the reader enters a charming literary garden.

ADVERTISING PAGES REMOVED

Gating Nonferrous Castings

(*Concluded from page* 31)

or slag. Some foundrymen contend that these skim gates are little more than retarders or valves in the path of the metal stream.

Pouring basin, Fig. 8. A basin above the sprue in which the metal may be poured in volume to permit a steady flow of metal through the sprue from the bottom of the bath of metal in the basin. This device prevents scummy material on the surface of the bath from going down into the sprue and thence to the mold cavity.

Gating Methods Vary

Gating of nonferrous castings is a subject that has had wide discussion. However, there is such a variety of alloys in the nonferrous field that a wide variety of gating methods is needed to accomplish the desired end. To establish standard gating for the phosphor bronzes and then use it for the production of manganese bronze would be just as ridiculous as it would be to gate a bronze casting as you would a gray iron casting. The subject of gating is one that must be attacked with the particular alloy to be cast as the fundamental factor in any discussion. Aluminum must be gated differently from the red brasses, or the bronzes. Magnesium requires another type of gating. Unless we are prepared to accept only generalties, the subject is large and requires a vast amount of detailed description.

Where castings are made in metal molds or semimetal molds (metal molds combined with dry sand cores) the gating is different from that used with the identical alloy in sand molds. One factor in gating castings is general and can be applied to all types of alloys and methods of gating; that is, the shape and size of the sprue. The shape of the sprue should be such that there is no difficulty in pouring the stream of metal from the ladle into it and continuing the stream unbroken. The sprue should be reamed out to a size where it does not require an expert to strike the opening.

Establish Proper Flow

Further, this sprue should be of such a size as to establish the proper amount of flow for the given mold cavity. When it is kept full, the flow through it to the runner and gates will be ample to supply metal at the proper speed and in sufficient quantities to satisfy all of the gating requirements. The sprue should be a valve to control the rapidity with which the metal enters the mold; thus making the pouring of the metal a simple process of filling the sprue and keeping it full of good clean metal. Some foundries use a skim gate to restrict the flow. Others have a restriction located in the runner. The best practice is to establish the right size of sprue to control the flow of the metal and then tell the pouring crew to keep the sprue full during the entire time of casting. Conditions thus will be standardized so that any troubles may be located definitely and there is no danger of carrying air into the mold with the inflow of metal. Sucking air into the metal is a very disastrous practice and one that has caused a great deal if not all of the trouble in casting many nonferrous alloys.

Another important point about the shape and design of the sprue is to have it smooth. In many instances it is desirable to have the sand well packed so that erosion by the passage of the stream of molten metal may not occur. Tearing the walls of the sprue by the passage of molten metal will result in the carrying of these loosened particles of sand into the runners or gates, and possibly through them even into the casting itself.

Consider the gating of yellow brass alloys, with particular reference to the yellow brasses produced without any aluminum in the alloy. Here the sprue should be of a size to permit filling the mold cavity as rapidly as possible. Where the wall thickness of the casting is a minimum, for example, a little more than $\frac{1}{8}$-inch thick, the gates should be arranged to lead the metal in at a number of points, if the area of the casting is large, so that the mold cavity may be filled rapidly and the resulting smoke spots reduced to the absolute minimum.

Several Sprues Necessary

Where the castings are large enough to require many gates, it will be found necessary to provide several sprues. Each of these sprues is fed by an individual stream of metal, either from a pouring pot for each sprue, or from a pouring basin arranged to supply this stream of metal for two or more sprues. This will lead the metal into the mold cavity with a minimum amount of agitation, yet at the maximum rate of speed to insure filling the mold in the shortest space of time. Yellow brass without aluminum is sluggish, compared with some of the other nonferrous alloys. Resistance to flow tends to produce cold shot seams and bubbles. Consequently, provision should be made for its entrance into the mold freely and rapidly. So far as possible all resistance to its flow should be removed. For example, vents freely should be provided to allow the air to flow out of the mold easily as it is replaced by metal entering the mold.

In very thin yellow brass castings, it will be found desirable to have the molds arranged on a sloping mold rack so that the metal upon entering will fill the mold from the lower side of the casting to the higher, thus insuring the continuous filling of the mold cavity instead of the spreading of the metal into several streams within the mold cavity later forced to unite and possibly forming seams or bubbles. Where the gates are attached to the casting no sharp edges should be permitted to exist. Fillets should be provided so that the in rushing metal cannot tear particles of sand loose and carry them into the mold cavity and thus make sand spots on the surface of the casting which causes a defect.

In spite of the general belief that yellow brass does not shrink to any extent it is a fact that yellow brass does shrink enough to require the necessary risers to feed heavy sec-

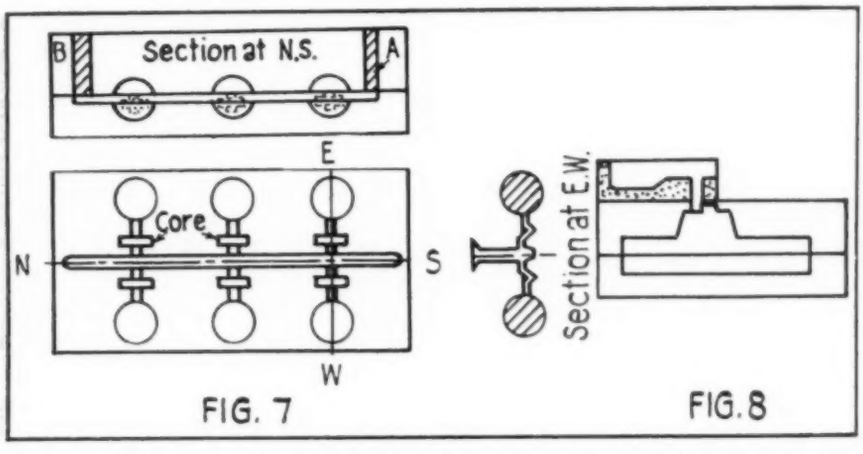


Fig. 7 (Left)—Plan and longitudinal section of skimmer gate layout for small castings. Fig. 8 (Right)—Showing application of pouring basin

tions. Otherwise shrink cavities will exist in these heavy sections or depressions in the surface will occur that would have to be corrected through the provision of adequate risers. Where risers are attached to castings, as in Fig. 4, the gates should be led into the risers as well as into the casting so that the hot metal will fill the riser and thus the temperature of the metal within the riser may be hotter than that in the casting. The temperature in the riser should be sufficiently in excess of that in the casting to insure the setting of the casting previous to the setting of the metal in the riser. Some yellow brass alloys shrink more than others, consequently are more in need of risers. If the section of casting to be fed is large enough to require a very large riser, the riser should be fed by adding hot metal thereto after the casting has been poured so as to increase the temperature of the metal in the riser distinctly in excess of the temperature of the casting. Care should be taken in pouring such metal into the riser to avoid excessive agitation.

Aluminum Forms a Film

In casting yellow brass to which aluminum has been added, it should be remembered that aluminum forms a very tenacious film of aluminum oxide over the molten brass and this film envelopes the entire surface and protects the metal from the oxidation that occurs as it passes through the air. This explains why the amount of zinc smoke from yellow brass with an aluminum content is so much less than from metal without aluminum.

However, this envelope, is a distinct advantage in one way, but in another way it is a source of trouble. When this envelope is broken and the stream is divided into two streams and then these two streams have to unite, the envelope resists this tendency to unite and may form a seam, which becomes a defect in the solidified casting.

Gating castings into which such alloys are poured, presents a problem requiring careful thought and full realization of the effect of this aluminum oxide envelope. This film or envelope is generated the moment the metal is exposed to the air. Consequently, agitation, which breaks the film and exposes metal to the air, generates more aluminum oxide. Agitation of this alloy results in a continued generation of the oxide. If it is agitated sufficiently, there may be enough oxide generated to form scum spots and a drossy appearance on the castings that will result in final rejection.

Gating of castings into which such alloys are poured requires that the gates permit the metal to enter the mold with absolutely minimum agitation and that all streams are permitted to unite into one solid mass of metal in parts of the casting of sufficient thickness to insure the complete absorption of any films and the complete union of all streams into one mass of metal. Of course, that one mass will be enveloped in the aluminum oxide film; but as the metal flows into the mold, this film gradually is spread over the surface of the sand mold and finally becomes an envelope enveloping the entire casting.

If the gating is such that the envelope has not been broken, but has been maintained as one continuous envelope throughout the process of casting; and if the final casting has then one envelope over the entire surface, it will be found to have an extremely smooth, clean skin, which upon removal by machining or polishing shows extremely fine sound metal underneath.

Where a large number of castings are made in one mold, each of them connected by gates to a common runner, it is desirable to plan this gating so that the metal completes the filling of the first castings before it spills over into the others to avoid cold shots or seams that are so commonly found in the yellow brass castings. If this cannot be done conveniently, the supply of metal through the sprue and runner should be sufficient to fill all castings more or less simultaneously.

In pouring yellow brass castings, it is important that the metal be poured into the sprue without permitting the stream to be broken after it has started into the mold. This is particularly important in casting yellow brass, whether it has an aluminum content or not. Molds for yellow brass also must be well vented.

British Institute Holds Meeting

The twenty-ninth annual autumn meeting of the British Institute of Metals was held in Sheffield from Sept. 6 to 9. The meeting opened on the evening of Monday, Sept. 6, with a reception by the Lord Mayor of Sheffield (Councillor Mrs. A. E. Longden), the senior Pro-Chancellor (Lieut.-Colonel Sir H. K. Stephenson) and the Vice-Chancellor of the University of Sheffield (Dr. A. W. Pickard-Cambridge).

During the evening, a short business meeting took place, at which the names of the officers nominated for the year 1938-39 were announced. These nominations being as follow: President: Prof. C. H. Desch, National Physical Laboratory, Teddington; Vice-President: Prof. J. H. Andrew, University of Sheffield; Members of Council: Dr. J. W. Donaldson, Scott's Shipbuilding & Engineering Co., Ltd., Greenock; Engineer Vice-Admiral G. Preece; H. S. Tasker, of Lingfield, Surrey.

The mornings of Sept. 7 and 8 were devoted to technical sessions, during which a number of papers were read and discussed, and in the afternoons a number of works visits were made. Dr. W. O. Alexander and Prof. D. Hanson, University of Birmingham, contributed the first part of the results of their investigations on "Copper-Rich Nickel-Aluminium-Copper Alloys: The Effect of Heat-Treatment on Hardness and Electrical Resistivity." The authors experimented on some 56 copper alloys containing quantities of nickel and aluminum varying up to 10 per cent by weight of each metal and which were cast and extruded. The effect of heat-treatment on the hardness and electrical resistivity of these alloys was observed. The results indicate that above 800 degrees Cent. all the alloys consist of uniform alpha solid solution. When heated at temperatures below 800 degrees Cent., some of the alloys harden, and their electrical resistivity decreases. The results reveal the approximate limits of the alpha solid solution, while the manner of the changes in properties at lower temperatures implies precipitation of new phases.

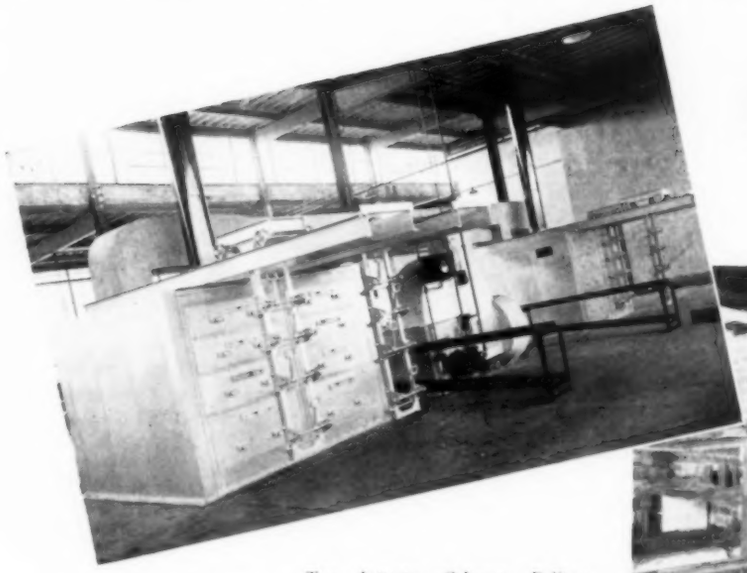
A paper entitled "The Mechanical Properties of Some Metals and Alloys Broken at Ultra High Speeds" was contributed by D. W. Ginns, Engineering Laboratories, Cambridge university. In this paper the author gives the results of investigations on the mechanical properties of carbon steels, copper, brasses, and aluminum alloys when broken in tension at very high speeds. It was found that the average time taken to reach the yield-point was 0.001-second, and to reach fracture, 0.005-second.

It is shown that, compared with the ordinary commercial tensile test values: (a) the yield-point is increased very considerably, over 100 per cent increase being recorded for some materials; (b) the maximum stress is increased by a much smaller amount; (c) the percentage elongation and the percentage reduction of area show comparatively small changes; (d) the types of fracture are almost identical with those obtained for the slow test.

"The Determination of Alumina in the Presence of Metallic Aluminium" was the title of a paper by G. B. Brook and A. G. Waddington, British Aluminium Co., Ltd., Kinlochleven. This paper describes an investigation into the volatilization process for the determination of alumina in the presence of metallic aluminum, using hydrogen chloride.

This method, according to the authors, has proved superior to any yet proposed.

Coleman "Rolling Drawer" Core Ovens



Two batteries Coleman Rolling Drawer Core Ovens heated by single oil-fired recirculating heating system. (Six batteries installed at this plant).

Battery of two Coleman Rolling Drawer Core Ovens, coke-fired.

THESE ovens are practically continuous core-baking machines. One or more drawers can be loaded or unloaded while the cores in the remaining drawers are being baked. Automatic closing plates prevent the escape of heat and gases.

Particularly suited for small and medium work, and will turn out more work for floor space occupied and fuel consumed than can be obtained by any other type of oven construction.

Patented double-suspension ball-bearing drawer pullers provide easy, vibrationless operation of even the most heavily loaded drawers.

Drawers run inside the oven on differential frictionless, self-aligning rollers which require absolutely no lubrication, regardless of oven temperatures.

Coleman Ovens are a product of over thirty years' specialization in core baking and mold drying. Over 4000 COLEMAN OVENS in successful operation in leading foundries everywhere.

BUILT IN ALL SIZES FOR OPERATION WITH ANY FUEL—

Gas, Oil, Coke, Stoker-coal, Powdered-coal, etc. Direct-fired and external recirculating heating systems.

COLEMAN OVENS ARE ALSO BUILT IN ALL OTHER TYPES, CONVEYOR, SHELF, CAR, SPECIAL, etc.

WRITE FOR COMPLETE CATALOGS.

The FOUNDRY EQUIPMENT Co.

BUILDERS OF COLEMAN AND SWARTWOUT OVENS
CONTRACTING ENGINEERS AND MANUFACTURERS

C L E V E L A N D • O H I O

Gray Cast Iron

(*Continued from page* 41)

nickel-copper-chrome and copper free irons are finding a wide field of application in corrosion resisting service such as in machinery used in chemical industries, oil refineries, paper production, textile plants, food handling plants, etc.

Development of alloyed gray irons during the past few years along with the higher alloy white irons has made available at low cost a series of corrosion resistant metals that have contributed greatly to the increasing use of cast irons.

Vibration Damping Capacity

By vibration damping capacity is meant the ability of a material to absorb or dampen vibration. It is defined as the amount of work dissipated into heat by a unit volume of the material during a completely reversed cycle of unit stress.

The vibration damping capacity of iron has been found to vary as the plastic deformation which means that the stiffer the iron the lower is its damping capacity. Broadly speaking then high total carbon, high graphite irons of low relative modulus of elasticity will have higher damping capacity than the lower carbon irons. Gray irons in general have much higher damping capacity than steels. This property of gray iron is of great value in castings used on machinery where vibration almost always is a factor in greater or less degree. It is one of the reasons for the use of huge tonnages of gray iron in machine tools, electrical equipment, automobiles, trucks, tractors, busses, engines, locomotives, pumps etc. where vibration is a vital operating problem.

Fig. 1, taken from a paper recently given before the New England section of the Society for Automotive Engineers by Fred J. Walls, International Nickel Co., New York, and reproduced in the March, 1937 issue of THE FOUNDRY, shows the relative vibration damping capacity of an S.A.E. 1020 steel and four cast irons. Here, again, the vibration damping capacity of iron is found of value in this relatively new field for cast iron.

Cover Wide Range

Almost any degree of tensile strength may be obtained, from about 15,000 to over 80,000 pounds per square inch, in plain and alloyed gray and white irons. Table II shows the composition and physical property ranges of plain and alloyed cast irons. Ranges shown necessarily are broad as they cover an almost numberless variety of compositions that are impossible to detail here.

A number of valuable and interesting relationships between various physical properties and tensile strength of gray irons have been evolved over a period of time. The following data, unless otherwise stated, are for gray irons with tensile strength in the range of 15,000 to 60,000 pounds per square inch.

Transverse strength test (cross-bending or flexural strength) of cast iron is the usual test by which producers of castings abide. The test is made on standard A.S.T.M. bars of various diameters to represent castings sections of various thickness. The test results are expressed as in the Table III. A convenient method of expression is the use of the modulus of rupture which is a useful means of comparison of results on test bars of various sizes.

Modulus of rupture expressed in pounds per square inch varies from about 2.45 to 1.3 times the tensile strength. The higher value applies to low tensile strength irons and the lower value to high tensile strength irons. It is important in engineering applications of certain types to have an accurate knowledge of the modulus of rupture. Thus a water pipe used at pressures correct for a 15,000 pounds per square inch tensile strength iron will carry an earth and truck load up to 40,000 pounds per square inch modulus of rupture. Compressive strength of cast irons ranges from about 4.2 to 2.5 times the tensile strength or from about 80,000 to 150,000 pounds per square inch. Here again the higher ratio applies to the low tensile strength irons and vice versa. High compressive strength of cast iron is one of its more important physical properties from an engineering standpoint.

Shear and Torsion

Shear strength of cast iron ranges from about 1.7 to 1.0 times the tensile strength according to Walls, the higher ratio of shear to tensile strength.

Torsional strength of cast irons apparently is a linear function of tensile strength according to Walls, who gives a formula for the relationship as follows:

$$X = 1.241\ Y + 4600$$

X is the ultimate torsional strength and Y is the ultimate tensile strength. The formula gives ultimate torsional strengths ranging from about 23,000 to 80,000 pounds per square inch for irons with tensile strengths of from 15,000 to 60,000 pounds per square inch. This property is of particular importance in the newer camshaft and crankshaft applications and in all types of service where torsional or twisting stresses are encountered.

Investigations of the fatigue resistance of cast irons have shown an endurance ratio of from 0.40 to 0.50. In other words, the endurance limit is from 0.40 to 0.50 of the tensile strength on unnotched bars. Lower ratio seems to apply to the lower tensile irons and vice versa. Endurance limits of irons with tensile strengths of from 15,000 to 60,000 pounds per square inch on this basis would range from 6000 to 30,000 pounds per square inch. Introduction of notches of various types apparently decreases fatigue stress up to about 25 per cent.

Since gray irons do not follow Hooke's law when loaded, but undergo both plastic and elastic deformation, the *relative modulus of elasticity* is used as a measure of stiffness under particular conditions of testing. The value is determined at ¼

(*Concluded on page* 101)

Table III

Composition and Property Range of Cast Irons

	Plain	Alloyed
Silicon	0.50–3.20	0.50–17.00
Carbon	2.50–3.75	2.00–3.75
Sulphur	0.12 max.	0.12 max.
Phosphorus	0.70 max.	0.30 max.
Manganese	0.45–1.00	0.50–3.75
Nickel	.....	0.15–30.00
Chromium	.....	0.10–35.00
Molybdenum	.....	0.20–1.25
Copper	.....	0.35–7.00
Aluminum	.....	1.00–1.75
Vanadium	.....	0.10–0.50
Titanium	.....	0.00–0.25
Tensile—Pounds per square inch x 10^{-3}	15–60	25–85
Transverse* Load—Pounds	1600–3600	2000–4500
Transverse* Deflection—Inches	0.20–0.35	0.20–0.42
Modulus of Elasticity—Pounds per square inch x 10^{-6}	10–22	12–30
Brinell	120–450	150–715

*Transverse bar 1.20-inch diameter tested on 18-0-inch supports.

ADVERTISING PAGES REMOVED

(*Concluded from page* 98)

the ultimate strength as being somewhat near the ultimate working stress in service. Relative modulus of elasticity may range from about 10 million pounds per square inch for the high carbon, weak irons to about 22 million pounds per square inch for the higher strength gray irons and up to 30 million for the highly alloyed white irons.

Investigations made on impact resistance of cast irons to date indicate a relation between transverse resilience and impact resistance. Tests on notched bars, such as are used for steel, are of little or no value for cast iron. Since no standardized impact test for cast iron is as yet available, no figures will be quoted. However, there is a wide variation in toughness or shock resistance of various irons and cast irons of suitable compositions are being used is various engineering applications where a considerable degree of toughness is required.

Castings Are Quenched

It might be well to note that strength properties of castings of suitable composition and design may be improved by quenching and drawing at certain temperatures. As mentioned when discussing wear resistance, irons are quenched and drawn usually to obtain high hardness but in certain instances they may be so heat treated for improved strength and structure. Data in Table II illustrate the possible improvements obtainable by heat treating.

Analysis of iron used is as follows: Silicon, 2.01 per cent; total carbon, 3.14 per cent; graphite, 2.32 per cent; combined carbon, 0.82 per cent; sulphur, 0.073 per cent; phosphorus, 0.214 per cent; manganese, 0.54 per cent; nickel, 0.39 per cent; chromium, 0.34 per cent; and molybdenum, 0.54 per cent.

Transverse strength of as cast bars 1.20 inch diameter tested on 12.0 inch centers, is:

	Load-pounds	Deflection-inches
1.	4560	0.10
2.	4460	0.10
Average	4510	0.10

Hardness is tested on the section of as cast bar midway between center and edge. The brinell hardness is 241.

Another type of heat treatment used to improve strength properties of castings is that of normalizing at temperatures ranging usually from 700 to 1050 degrees Fahr. followed by slow cooling. This treatment is used to effect relief of internal strains. This treatment will improve strength and shock resistance in varying degrees depending on amount of internal stress present. This heat treatment practically has no effect on hardness or structure.

The excellent machinability of cast iron is one of the important reasons for its widespread use in engineering applications particularly in industries where mass production prevails.

Irons with brinell hardness in the range of 120 to 170 are extremely easy to machine with almost any type cutting tool. As the hardness is increased to about 220 the machinability still is quite good although, with high machining speeds, high speed tool steel usually is used. As the hardness is increased up to about 300 brinnell, the machinability becomes more difficult so that in many applications the newer cemented carbide type cutting tool is used.

All of the above discussion applies to ferritic, pearlitic and sorbitic irons in which large areas of free cementite are absent and in which the phosphorus content is below 0.30 per cent in most cases. It also implies castings that are free of hard spots, chilled edges, sand inclusions and burned on sand, all of which are ruinous to the life of practically any cutting tool. Annealing at temperatures of from 1100 to 1550 degrees Fahr. is employed frequently to improve machinability of gray irons at some sacrifice of strength.

Gray irons can be and are cast in practically any type of engineering design desired. As melting methods have been improved and new types of melting equipment utilized, problems of obtaining metals of practically any composition and at any temperature up to about 3000 degrees Fahr. have been solved and readily are obtainable.

Castings of iron are used in many cases because of ease with which the ultimate design and dimensions are obtained with the elimination of many costly machining operations. Weight range of present day castings is from a few ounces to many tons and the section range from about 3/16-inch or less to 5 or 6 feet or more.

Few test data available indicate that the creep strength of cast iron is practically the same as its ultimate tensile strength after set is removed. Tensile strength of gray irons is little affected by temperatures up to 800 degrees Fahr. Above that figure the strength decreases and above 900 degrees Fahr. the decrease is rapid.

Cast irons offer a variety of properties to the engineering profession. The range of usefulness and fields of application constantly are being widened. More fundamental research has been done in the past 10 years on cast iron than was done in many preceding years. The increasing search for and development of higher physical properties suited to particular applications will assure the increasing use of this economical and valuable engineering material.

Makes Graphitizer For Cast Iron

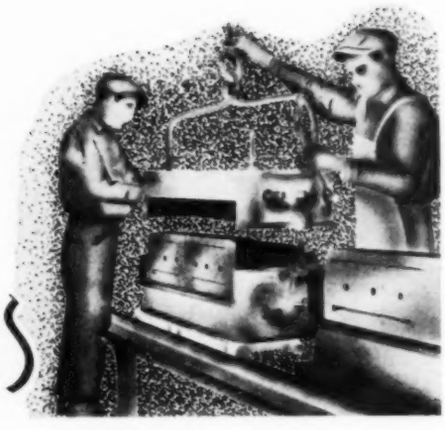
A new graphitizing compound has been developed by the Electro Metallurgical Co., New York, for use in gray iron foundries to aid in producing castings of greater uniformity and improved machinability. The compound is said to act both as a deoxidizer and graphitizer, and to be particularly useful in controlling the tendency of castings to chill in light sections and at corners.

Additions of 2 to 8 ounces of the special graphitizer to 100 pounds of cast iron are said to reduce the depth of chill, soften light sections, and improve machinability. The additions refine the graphite in heavy sections and thus improve the strength and uniformity of the iron. Also it is claimed that the graphitizer improves fluidity, but does not change appreciably the composition of the iron. It promotes the formation of normal flake graphite and tends to eliminate eutectic graphite areas. It is convenient and easy to use, and is of particular value when only a hard base metal is available, or when uncontrollable changes in operation of the cupola would cause excessive chilling.

Effect of graphitizer on chill. Top without addition, and bottom, with 0.25 per cent of the graphitizer

The accompanying illustration indicates the reduction of chill that can be accomplished by the addition of the graphitizer. The base iron contains 3.20 per cent total carbon, and 2.26 per cent silicon. In the illustration the fracture shown at the top is without any addition while the fracture shown below has had an addition of 0.25 per cent of the special graphitizer. The sections shown in the illustration are about three-fourths actual size.

NEW EQUIPMENT for FOUNDRIES



Sand Blender

Royer Foundry & Machine Co., Kingston, Pa., recently has introduced the use of pneumatic tire and roller bearings as standard equipment on all portable models of its line of sand separators and blenders. As shown in the accompanying illustration, the pneumatic tires increase the ease with which the unit may be moved on soft sand floors or those pitted or spotted with hillocks.

All portable models are equipped with pneumatic tires

Blast Heater

A new blast heater for heating, ventilating, air conditioning and process application has been developed by Modine Mfg. Co., Racine, Wis. It is claimed that the heater incorporates new features of design which materially increase structural strength and make for more effective high heat transfer. These include elimination of expansion strain by an expansion bend which allows each tube to expand and contract as its temperature requires, without affecting the tube adjacent to it. Headers and tubes are cylindrical and seamless for greatest possible structural strength. Tubes and headers are brazed into a single rugged unit without use of gaskets, bolts or screw joints.

All steam carrying passages of the heater condenser including headers, tubes, and inlet and outlet bosses, are of pure copper or copper alloy. Fins are bonded metallically to tubes to make a permanent junction. Greater heat transfer is promoted by specially designed fins to give effective turbulence to the air. Orificing of tubes has been eliminated, it is claimed, by use of a special steam distributing plate which rations steam evenly to all tubes, the full width of the condenser. A large variety of sizes and capacities of heaters are available.

Aluminum Guard

Ellwood Safety Appliance Co., Ellwood City, Pa., has developed an aluminum alloy shin guard which may be attached to the special foot guard, incorporating silent toe piece and quick fastening attachments. The unit is designed to give foot and leg protection against hazards in industry.

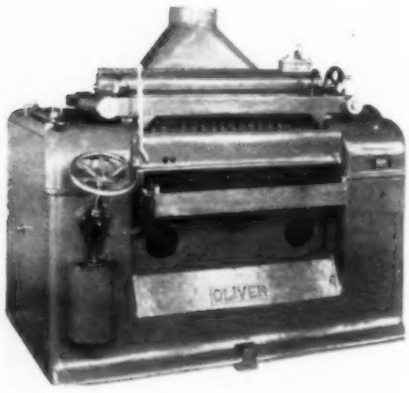
The shin guard may be attached to the special foot guard

Surface Planer

Oliver Machinery Co., Grand Rapids, Mich., has introduced a new planer with a wide range of capacity in both hard and soft woods. Two motors drive the machine. A high speed direct mounted motor drives the cylinder or cutter head and a 4-speed motor drives the feed work. The machine has a capacity of 30 inches in width and 8 inches in thickness. It can be supplied with four rates of feed, namely 20, 30, 40, and 60 feet per minute, or with faster or slower rates of feed if desired.

The base is a 1-piece casting with three point floor bearing. One-piece construction of upper housings is said to eliminate bolted girders, and to secure permanent alignment. The feed mechanism is totally enclosed. The worm gear drive for feed rolls is totally enclosed and ball bearings are employed for all revolving parts. Both mechanical and electrical control is from a central location. The machine has a hand brake for stopping the cylinder quickly when that is desired.

A view of the front of the machine showing the push-button control, cylinder brake lever, power hoist table and drum control, is shown in the accompanying illustration.



Front of planer showing push button and other controls

AJAX TOMBASIL INGOTS

(Tombac - Silicon)

A NEW ALLOY

WITH UNIQUE PROPERTIES

ASSOCIATE COMPANIES

Ajax Electric Furnace Corporation

Ajax-Wyatt Induction Furnaces for melting.

Ajax Electrothermic Corporation

Ajax-Northrup Induction Furnaces for melting and localized heating and hardening.

Ajax Electric Co. Inc.

Ajax-Hultgren Salt Bath Furnace and Resistance Type Electric Furnaces for all heat treating operations.

•

Ajax Standard Ingots

Ajax Plastic Bronze
Ajax Phosphor Bronze
Ajax Red Brass Ingots
Ajax Manganese Bronze
Ajax Anti-Acid Bronze
Ajax Hydraulic Bronze
Ajax Golden Glow Yellow Brass
Ajax Nickel Alloys
Ajax Aluminum Alloys
Ajax Manganese Copper
Ajax Phosphor Copper
Ajax Silicon Copper
Ajax Phosphor Tin
Ajax Nickel-Copper 50-50%

A new Copper-Zinc-Silicon Alloy having unique properties—manufactured and distributed in ingot form under exclusive license agreement with the Anaconda-American Brass Company for the production of sand, chill and die castings not afterwards intended to be wrought.

UNIQUE IN THE FOUNDRY

1 – It is a high strength metal with less shrinkage than Manganese or Aluminum Bronze.
2 – Forms little dross and, therefore, produces castings having a smooth skin of pleasing color.
3 – So free flowing that castings of intricate ornamental design are true to pattern.

UNIQUE FOR DIE AND CHILL CASTINGS

1 – Can be cast at low temperature, thus insuring long die life.
2 – Produces beautiful surface free of oxide.
3 – High strength and hardness.

UNIQUE IN SERVICE

1 – Physical properties as determined under tension are between Gun Metal and Manganese and Aluminum Bronzes—hardness is greater
2 – Excels in corrosion resistance.
3 – Wonderful wearing properties.

Attractively cheaper than 88 Copper 10 Tin 2 Zinc, 88 Copper 8 Tin 4 Zinc and Aluminum Bronze.

PUBLICATION REFERENCES

United States Letters Patent No. 1,933,390 to Ray and Gould.
"Effects of Silicon on the Properties of Brass", METALS AND ALLOYS, April and May, 1930, issues.
"A New Silicon-Zinc-Copper Alloy", THE METAL INDUSTRY (Great Britain) October 3 and 17, 1930 issues.
"Die Casting Brass and Other New Alloys", METAL PROGRESS July, 1931 issue.

Brass, Bronze, Nickel and Aluminum Alloys produced to all specifications.

THE AJAX METAL COMPANY

Established 1880

PHILADELPHIA

NEW YORK CHICAGO CLEVELAND

Encased Brick

A new form of steel-encased magnesite refractory brick now is being supplied by the Harbison-Walker Refractories Co., Pittsburgh, for industrial furnace applications where operating conditions are severe. The brick itself is chemically bonded magnesite which provides high refractory qualities and resistance to basic slags. After being molded to size accurately under heavy pressure, each brick is encased on three sides in a mild steel jacket, as shown in the accompanying illustration. As those bricks generally are laid-up as headers, the furnace wall or lining will be constructed of bricks which are jacketed except at the ends.

Each brick is encased on three sides in a mild steel jacket

At operating temperatures, the ends of the jackets at the heated face oxidize and melt, fusing with the brick to form a monolithic surface. At a short distance back from the hot face it is said the steel remains intact, adding to resistance of the wall against spalling and to the internal strength of the entire structure. Uses for the brick include walls of basic open-hearth and electric steel furnaces, cement and dolomite kilns, and other high temperature kilns where physical strength and resistance to basic slags are equally essential.

Lamp Reflector

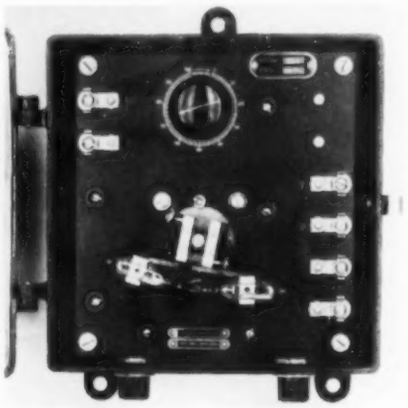
Westinghouse Electric & Mfg. Co., East Pittsburgh, has developed a new 250-watt aluminum reflector and glass cover for various applications. It is designed to provide intensive general illumination where the mounting light is not over 20 feet. Higher intensities are provided on the working planes, with minimum losses on the side walls. The unit consists of a deep bowl-type aluminum reflector, a dust-tight cover, various types of hoods for a ½-inch conduit and outlet box mounting.

Reflector is designed to provide intensive general illumination

The reflectors are made from 16 gage aluminum sheet. The medium socket is mounted rigidly in the hood to locate the lamp properly in the reflector. The clear glass cover is hinged directly to the reflector bead, supported at three points. It is released by unsnapping two latches. A heavy waterproof felt provides a gasket between reflector and lens. The entire reflector is finished by the alzac process for permanence and cleaning ease.

Pyrometer Device

Bristol Co., Waterbury, Conn., has introduced a device for use with automatic pyrometer controllers used with industrial heating furnaces for the purpose of anticipating temperature changes and of correcting the fuel consumption in advance to prevent the temperature from rising above or falling below the control point. It is claimed that the device can be used for practically all of the commonly used types of pyrometer controllers, and can be added to present installations as well as incorporated in the control circuit of new equipment.

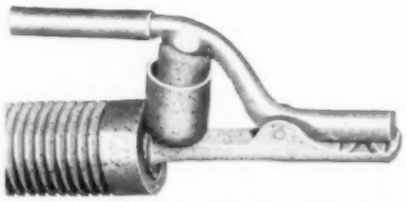


Pyrometer device developed to anticipate temperature changes

It is claimed that the device adds to or subtracts an electromotive force from the regular thermocouple circuit which causes the controller to act in anticipation of a temperature change. The auxiliary electromotive force is derived from thermocouples in the case of the device. These are connected in series but oppose each other. Magnitude of the electromotive force is produced by the thermocouples and is dependent upon the temperature change trends.

Electrode Holder

Jackson Electrode Holder Co., Detroit, is marketing a new electrode holder which weighs 15 ounces and has a current capactiy of 200 amperes. The holder is designed for light work, and handles rods from 1/16 to 3/16-inch in diameter. The holder is made of a copper alloy which has 85 per cent of the conductivity of pure copper but considerably greater strength. Handle insulation of the holder, which is shown in the accompanying illustration, is claimed to be ventilated thoroughly. Upper tong and compression spring are protected by insulation.



Handle insulation of electrode holder is well ventilated

Beam Recorder

A new type of recorder has been developed recently by the C. J. Tagliabue Mfg. Co., Park and Nostrand avenues, Brooklyn, N. Y. Shown in the accompanying illustration, a sensitive mirror galvanometer is the primary controlling element, in which an inertialess beam of light takes the place of the customary metal boom or pointer. The beam of light from the galvanometer, in moving on and off a phototube, passes the controlling edge of a screen, thus operating relays which in turn control a reversing motor which drives the moving contact of the bridge or potentiometer.

The phototube is not a calibrated element but serves only to detect the direction of the light beam and bring the galvanometer to zero deflection, according to the well-known method of balancing an electric circuit. The new instrument, therefore, is not a photoelectric potentiometer in the sense that a balance of photoelectric current is implied.

Mirror galvanometer is controller

ADVERTISING PAGES REMOVED

Wood or Metal Saw

Wells Mfg. Corp., Three Rivers, Mich., has developed an upright saw which may be used for wood or metal. The saw has nine speeds

The upright frame may be swung to handle large work on the floor

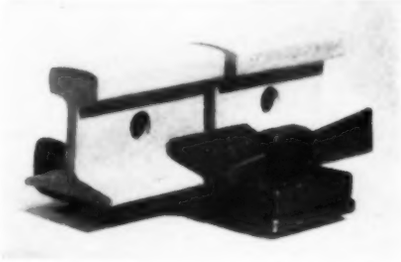
ranging from 60 to 1400 feet per minute. It has a throat clearance of 14 inches vertically and 14½ inches horizontally. It may be used in a rigid upright position for sheet metal, pattern work, sawing sprues off castings, or other work for which a rigid upright saw is applicable. The table is arranged to tilt 45 degrees right and 10 degrees left.

The upright saw frame is hinged at the bottom and may be released and fed into the stock automatically. The stock is claimped on the table with a vise which is provided. By using T slots and clamps, a greater variety of work may be accomplished. The upright frame swings down to the floor where gates and risers may be cut off large castings which are too heavy to place on the table. The capacity at this point is 14 x 18 inches.

Rail Splicer

Portable Lamp & Equipment Co., Pittsburgh, is manufacturing a new rail splicer of malleable iron for use in joining temporary tracks laid in mines, quarries, or industrial plant or brick yards. The splicer shown in the accompanying illustration is claimed to be resistant to corrosion and shock and is cast with smooth surfaces true to pattern.

No fish plates, bolts or nuts are used. Special design facilitates speedy application of the splicer which is made in three parts—main section, wedge, and wedge plate. The main section fits under and flush against the inside of the rails being joined. Two lugs on this part engage the rail holes.

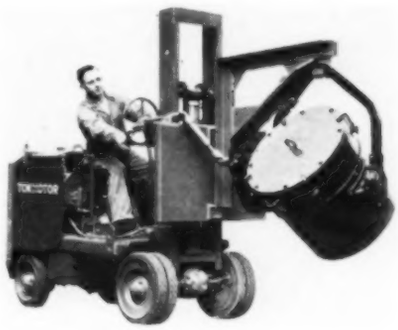


Malleable cast iron rail splicer is used for joining temporary tracks laid in industrial yards

Lift Truck

Towmotor Co., 1226 East 152nd street, Cleveland, has introduced a new ladle handling lift truck, as shown in the accompanying illustration. The truck includes a vertical lifting arrangement, swinging arms and ladle-tilting mechanism to handle a ladle having a capacity of 2000 pounds of molten iron. A universal-jointed tilting wheel, mounted on the truck is attached to the mechanism.

Height of the hydraulic lift from floor to lip of ladle in pouring position can be adjusted from a few inches above the floor to any specific height. The maximum pouring



This model may be raised to any height to 50 inches

height on the unit illustrated is 50 inches. The minimum is 18 inches. The structural unit from which the ladle is suspended hinges on a plate attached to the hoisting mechanism. This permits the ladle to be swung from one side to the other.

Emergency Kit

Davis Emergency Equipment Co. Inc., 55 Van Dam street, New York, has developed a first-aid kit designed specifically for emergency treatment of burns. The kit contains 12 gauze compresses which can be opened up in progressively larger sizes so that they can be used for covering small or large areas; 12 six-yard lengths of 4-inch bandage for holding the dressings in place; 6 five-ounce tubes of tannoid, the tannic acid treatment for burns; and three packages of wooden applicators for applying the treatment. All items are packed in unit cartons and the supply as a whole is sufficient for burns involving the entire body.

Color Pyrometer

Pyrometer Instrument Co., 103 Lafayette street, New York, has introduced a combined color pyrometer based on the use of light filters

The pyrometer is based on the use of light filters and color wedges

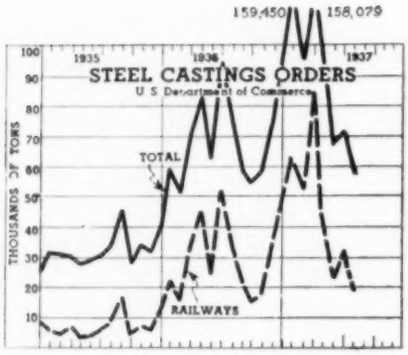
and color wedges which are transparent to a number of colors simultaneously. In this pyrometer, the temperature of the black body and the actual temperature may be ascertained simultaneously. The instrument is supplied with scale ranges from 900 to 1900 degrees Cent. or 1700 to 3500 degrees Fahr. The new instrument may be used for many laboratory and research applications including incandescent iron and iron alloys, etc.

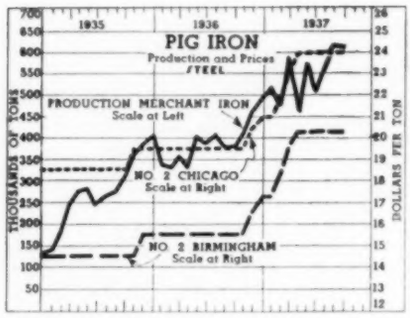
Roof Ventilator

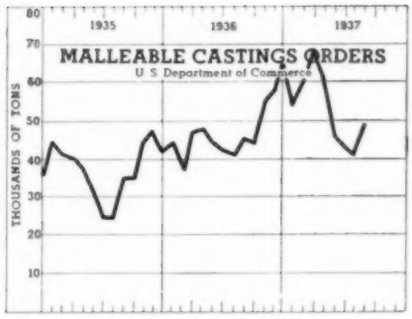
Swartwout Co., 18511 Euclid avenue, Cleveland, has developed a new rotary roof ventilator for industrial and commercial building applications. The basic principle is the same as in previous ventilators made by that company, but new details have been introduced in the construction. New stainless steel, fully enclosed, dust-tight, oilless ball bearings carry the head as it turns with the wind. Interior construction is of steel tubing welded into a 1-piece head frame which provides high strength and low friction resistance.

The ventilator is made in sizes from 12 to 72 inches throat diameter.

The head turns in the wind on anti-friction bearings







FOUNDRY ACTIVITIES

JOHN HARSCH BRONZE & FOUNDRY CO., Cleveland, recently purchased the former plant of the Lakewood Engineering Co., 12502 Berea road, Lakewood, O., from the Jaeger Machine Co., Columbus, O. The plant, which has two 1-story buildings containing 40,000 square feet of space, will be supplemented by a third building 60 x 150 feet to be erected by the Harsch company. Equipment costing approximately $25,000 will be installed. It is expected that the foundry will be located in the new quarters around the first of the year.

* * *

Beaumont Aluminum & Brass Foundry, Beaumont, Tex., has been organized to engage in foundry business by L. B. Jones and E. Best.

* * *

Newnam Foundry Co., Kendallville, Ind., which recently was damaged by fire, has been repaired and is again in operation.

* * *

Production of steel castings increased during August, according to reports received by the Industrial Research department of the University of Pennsylvania. Total production was 24.0 per cent higher than that for August, 1936. Production of gray iron castings during August was 0.8 per cent less than in the previous month and for the first time in 2 years was less than the production figure for the previous year, being 3.5 per cent below that of August, 1936.

RAW MATERIAL PRICES

Oct. 4, 1937

Iron	
No. 2 foundry, Valley	$24.00
No. 2 Southern Birmingham	20.00
No. 2 foundry, Chicago	24.00
No. 2 foundry, Buffalo	24.00
Basic, Buffalo	23.00
Basic, Valley	23.50
Malleable, Chicago	24.00
Malleable, Buffalo	24.50
Charcoal iron, furnace	27.00
Coke	
Connellsville beehive premium	$ 6.00 to $ 6.50
Wise county beehive coke	6.25 to 6.50
Detroit by-product delivered	11.10
Scrap	
Heavy melting steel, Valley	$18.00 to $18.50
Heavy melting steel, Pitts. (div.)	17.50 to 18.00
Heavy melting steel, Chicago	15.50 to 16.00
Stove plate, Buffalo	14.50 to 15.00
Stove plate, Chicago	10.50 to 11.00
No. 1 cast, New York	14.50 to 15.00
No. 1 cast, mchy., Chicago	14.50 to 15.00
No. 1 cast, Pittsburgh	18.50 to 19.00
No. 1 cast, Philadelphia	19.50 to 20.00
No. 1 cast, Birmingham	15.50 to 16.00
Car wheels, iron, Pittsburgh	19.00 to 19.50
Car wheels, iron, Chicago	18.00 to 18.50
Railroad malleable, Chicago	17.25 to 17.75
Malleable, Buffalo	18.50 to 19.00
Nonferrous Metals	**Cents per pound**
Castings copper, refinery	12.50
Straights tin	57.37½
Aluminum, 99 per cent	20.00
Aluminum, No. 12 (Secondary, standard)	18.50
Lead, New York	6.00
Antimony, New York	17.37½
Nickel, electro	35.00
Zinc, East St. Louis, Ill.	6.50

Coast Foundry & Mfg. Co., 3474 Union Pacific avenue, Los Angeles, is building an addition to its foundry 25 x 42 feet.

* * *

Keeler Brass Co., Grand Rapids, Mich., has awarded general contract for the construction of an addition to its factory building, to H. Hauser Construction Co., Grand Rapids.

* * *

Malleable Iron Range Co., Beaver Dam, Wis., has started work on a foundry addition, 50 x 200 feet to meet its increased needs for castings. F. W. Rogers is president.

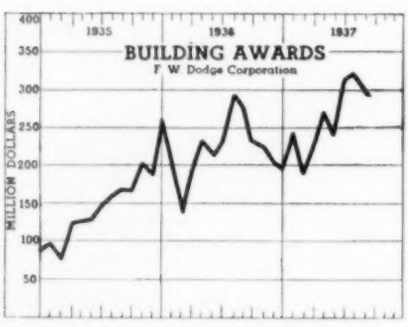
* * *

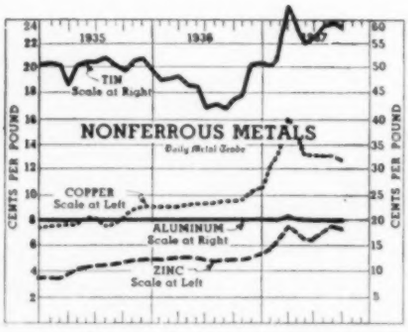
Aluminum-Brass Foundry Co., 908 North Main street, Los Angeles, is constructing a foundry building on a lot 44 x 100 feet, at 1518-1522 North Spring street, Los Angeles.

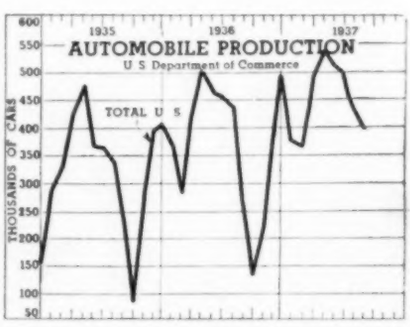
* * *

Dain Mfg. Co., Ottumwa, Iowa, subsidiary of Deere & Co., has awarded contract for erection of six factory buildings to include a paint shop, woodworking shop, extension to its present foundry, finished stock storage building, tool manufacturing building and foundry sand

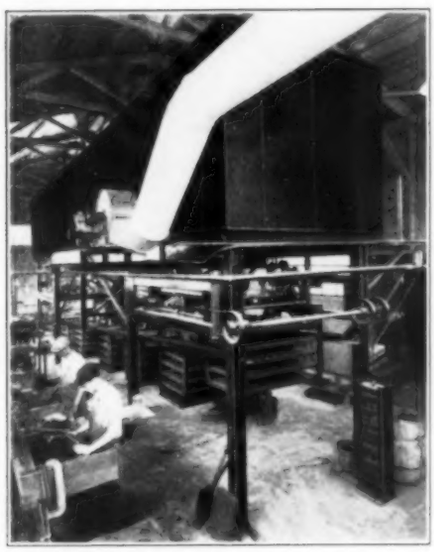
(*Concluded on page* 110)







QUALITY . . .
with ECONOMY!



IN MAINTAINING its high standards, the maker of quality automobiles is especially discriminating in the selection of its production equipment. Excellence of results must come first. To this, must be coupled efficient operation; otherwise, quality of product cannot go with production economy.

The foundry of one of the leading car companies is soon to have a horizontal, overhead, continuous Core Oven, 147′ 6″ long by 14′ 11″ wide and 9′ 0″ high, served by a single chain conveyor, carrying racks each having 7 shelves. These will pass next the core machines, thus being directly loaded and carried into the oven.

Heating is by a Young Brothers Company remote (or external) gas fired heater, using recirculation. The efficient counterflow of air and work, and special cooling features as developed by our Company, together with automatic control and safety features—all will combine to make a noteworthy installation.

In all fields requiring Industrial Ovens, you will frequently find Young Brothers Company equipment.

Wherever more exacting or difficult oven problems are encountered, they are often the first ones consulted.

Progress without experimentation on a production scale, is their guide; and this is backed by an organization which had an important part in raising the modern oven to its present high standard.

CAN OUR ENGINEERS ALSO ASSIST YOU?

YB Co

YOUNG BROTHERS COMPANY

35 YEARS EXPERIENCE BUILDING

Industrial Ovens

FOR ALL PURPOSES

6500 Mack Avenue • DETROIT, MICHIGAN

(*Concluded from page* 108)
storage building, to Lanning Construction Co. The entire project will cost approximately $100,000, exclusive of equipment.

* * *

Duncan Foundry & Machine Works, Alton, Ill., which recently was damaged by fire to the extent of $150,000, plans making repairs and alterations to its shop and plant at a cost to exceed $60,000.

* * *

Kalamazoo Stove & Furnace Co., Kalamazoo, Mich., is planning to erect a manufacturing plant in Utica, N. Y. The new factory will provide 60,000 square feet of additional manufacturing space.

* * *

R. R. Howell & Co., Minneapolis, soon will start construction of a one-story plant addition, part of which will be used to store patterns. Benjamin R. Howell is president.

* * *

G. S. Blakeslee & Co. is building a plant addition at 19th street and Fifty-second avenue, Cicero, Ill., which will increase the manufacturing space 50 per cent.

* * *

LaPorte Foundry Co., LaPorte, Ind., is building an addition, 60 x 127 feet, to its plant. It is expected to be ready for occupancy about the middle of October.

* * *

B. F. Johnson and Wilton Thompson, formerly operators of the Capitol Foundry Co., Minneapolis, now are operating a new foundry on Western avenue, Minot, N. D.

* * *

General Electric Co., Schenectady, N. Y. is building a one-story addition to its branch plant on East Lake road, Erie, Pa. The new building is for foundry expansion and will cost over $50,000 with equipment.

* * *

Wellman Bronze & Aluminum Co., 6017 Superior avenue, Cleveland, is installing electric power equipment in the new addition it is erecting to its bronze bearing and bushing manufacturing plant.

* * *

Herzog Iron Works Inc., St. Paul, manufacturers of ornamental iron and bronze, recently erected a new $100,000 factory building. Harry F. Fisher is president of the company.

* * *

United States Cast Iron Pipe & Foundry Co. at Scottdale, Pa., has been purchased by Sterling H. Bonsall, Beverly, N. J. The plant now is being operated as the Duraloy Co. to manufacture a special steel alloy.

* * *

Caterpillar Tractor Co., Peoria, Ill., recently has completed factory additions at a cost of approximately a half million dollars. An apprenticeship department will be included as a department in the new two-story building.

* * *

Index of foundry equipment orders for August, according to a report of the Foundry Equipment Manufacturers' association, Cleveland, was 257.5 as compared with 204.0 in July and 144.8 in August, 1936. Index of shipments for August was 266.6 as against 216.5 in July and 137.2 in August of the previous year.

* * *

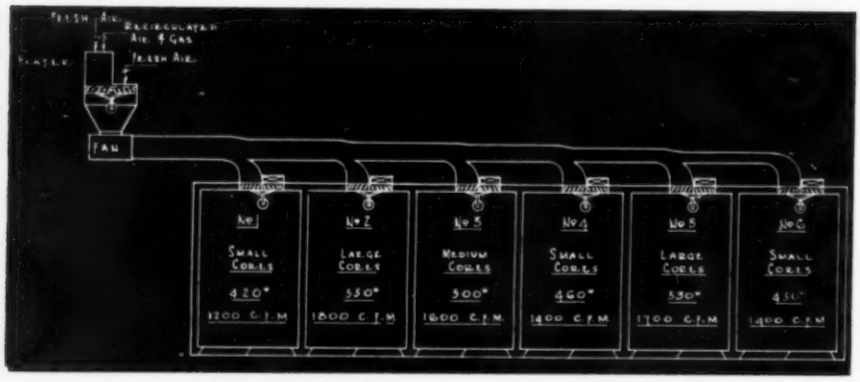
Light Alloys Mfg. Co., Painesville, O., organized to succeed the Light Alloys Co. whose plant was recently destroyed by fire, has leased the former factory of the Bakelite Co. for the production of aluminum castings and similar specialties. A. E. Walton is president and R. E. Palmer, vice president and treasurer.

* * *

Bremen Aluminum & Brass Products Corp., Bremen, Ind., has completed a new foundry building. New equipment has been installed throughout and a new patternshop is included in the project. Louis Newell is president and Vernon Fritz, secretary-treasurer.

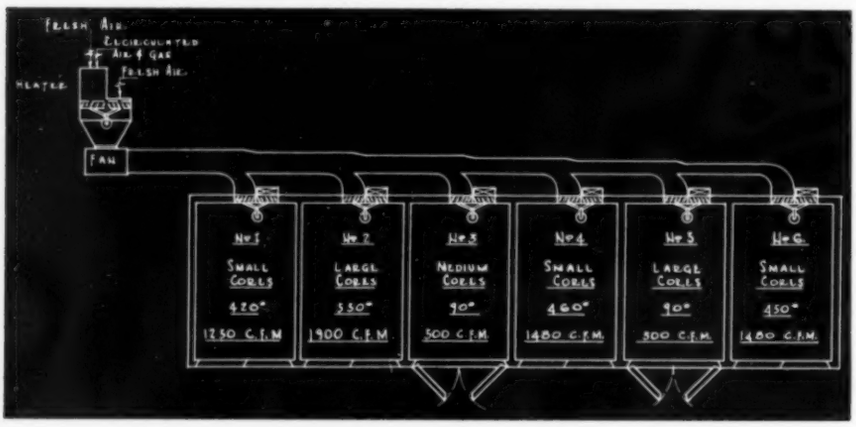
Modernize Your Batch Type Ovens

The D.S.M. Recirculation system permits a single external heater to serve a number of ovens, all of which may require different baking periods and temperatures. For different sizes and shapes of cores.



DIAGRAMATIC LAYOUT—Varying temperatures and volumes in adjoining compartments. One isolated heater—oil or gas fired. Automatic temperature control.

Open an oven or two for unloading. What happens? The temperature in the opened oven is automatically cut off, cold air circulated, and the other ovens continue on under their same baking conditions. No practical change in air volumes or temperatures:



Two compartments opened for unloading. Temperature and volume factors automatically change as indicated above, leaving unchanged temperature and circulation in the compartments still undergoing baking when one or more compartments are being unloaded.

AND IT IS ALL AUTOMATIC. No shifting of hand dampers. The above cuts are diagramatic only, and are not intended to illustrate the interior circulating system in the ovens. Sketch and dimensions of your present installation will enable us to advise cost of modernization.

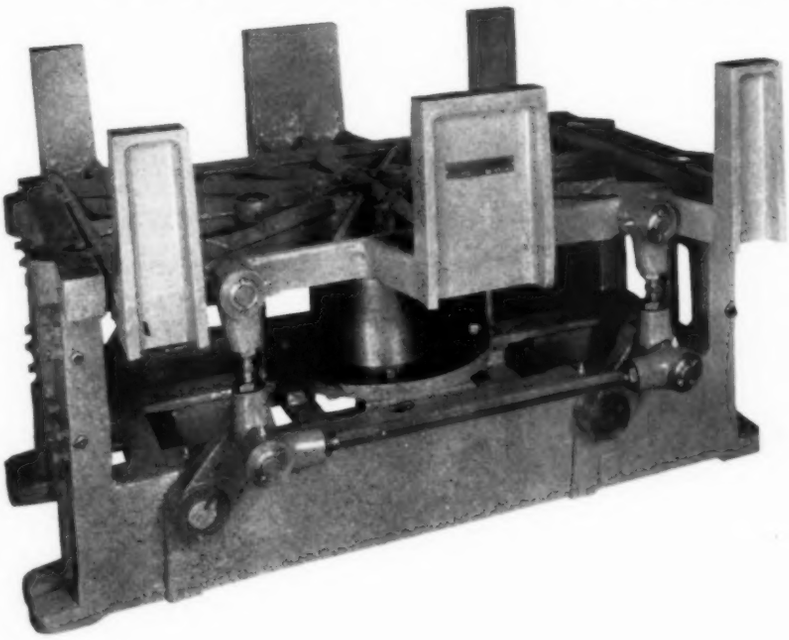
DETROIT SHEET METAL WORKS

DETROIT - - MICHIGAN

1270 Oakman Boulevard

STRIPPING PLATE MACHINES

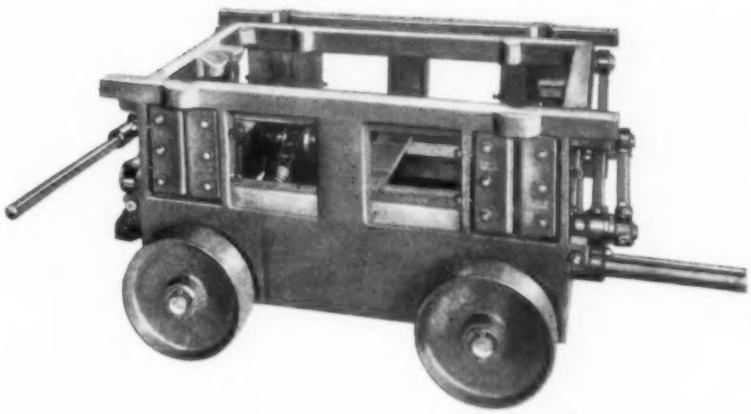
POWER OR HAND OPERATED—ALL SIZES



POWER STRIPPING PLATE MACHINE (shown left). For mounting two cylinder blocks in a flask. Built sturdy for continuous production. Hardened and ground steel pins and bushings in all connections and lifting yoke. Cast steel lifting yoke.

Adjustable V gibs and connecting rods.

Built low for convenient ramming.

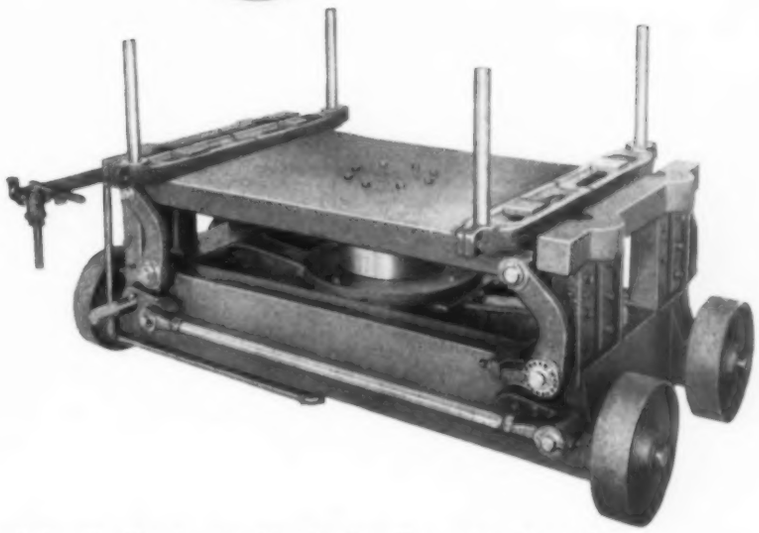


HAND STRIPPING PLATE MACHINES in all sizes.

Round or square.

FLASK LIFT MACHINE (shown right) has adjustable lifting posts. Job changes are made quickly. Used for boiler section work, etc. On one particular installation, eight different sizes of patterns are changed daily.

Our engineering department will gladly make recommendations and quote on your requirements.



Canadian representative—John T. Hepburn, Limited.—Toronto, Canada

CHAMPION FOUNDRY & MACHINE CO.

3018 West 21st Place
CHICAGO, ILLINOIS

NEW TRADE PUBLICATIONS

Copies of any of the literature listed below may be obtained by writing directly to the companies involved, or by addressing THE FOUNDRY, in care of Readers' Service Department, 1213 West Third Street, Cleveland

ALLOYED IRONS—International Nickel Co. Inc., 67 Wall street, New York, recently has published the sixth division of Section 1 on its nickel cast iron data book. The presentation deals with alloyed cast irons in petroleum refining equipment. The text treats properties, applications, and other pertinent information.

DIESEL TRACTORS—Caterpillar Tractor Co., Peoria, Ill., recently has issued its booklet, Form 4189, which treats diesel tractors at work with trailbuilders, bulldozers, brush cutters, winches, scrapers, tamping welders and rippers. Photographs illustrate types of work in which these machines are used.

MOTOR PUMPS—Ingersoll-Rand Co., 11 Broadway, New York, recently has issued a new catalog describing its motorpumps. The booklet describes the machines and includes data on capacity and motor sizes.

RUBBER HOSE—United States Rubber Products Inc., 1790 Broadway, New York, has issued information on rubber hose for industrial use, giving its complete line. The booklet contains 48 pages of illustrations and data.

BRONZE BEARINGS—R. W. Rhoades Metaline Co. Inc., P. O. Box No. 1, Long Island City, N. Y., has published a folder on its oilless bronze bearings. Their use, operation and construction are described.

GRAB BUCKET—Hayward Co., 50 Church street, New York, has issued a booklet describing its new clam shell bucket for coal, coke and similar bulk materials. The publication describes the construction of the bucket and shows photographs of installations.

COMPRESSORS — Worthington Pump & Machinery Corp., Harrison, N. J., has described its new line of horizontal heavy-duty steam driven compressors in a recent bulletin. Various installations and types are illustrated with description of mechanical features.

POWER UNITS—Fairbanks, Morse & Co., 900 South Wabash avenue, Chicago, describes the construction and applications of its new model diesel power units in a recent publication. Sectional view and illustrations emphasize economy, operation and service of the units, which are offered in two cylinder sizes.

DISK WHEELS—Norton Co., Worcester, Mass., pictures 8 different disk grinding jobs in a folder prepared recently describing its line of abrasives, bonds, grades, grains and structure. Its disk wheels are listed and cylinder wheels with inserted lug and plate mountings are discussed briefly.

LOCOMOTIVE CRANES — American Hoist & Derrick Co., St. Paul, Minn., has developed a well-illustrated booklet on its various cranes for hoisting all types of work. The handling of coal, ties, poles, bridges, box cars, girders, scrap, etc., excavating, and the loading of pigs with a magnet are a few of the interesting photographs shown.

INDUSTRIAL SITES—Industrial commission, City of Paterson, N. J., recently has published a well-illustrated, 72-page booklet on "Industrial Advantages of a Paterson Location." The presentation has been prepared by Herbert S. Swan, industrial consultant. Scenes in local foundries are displayed prominently among the illustrations.

RECORDERS—Leeds & Northrup, 4934 Stenton avenue, Philadelphia, has employed a novel method for presenting its micromax recorder. The bulletin is cut to actual shape of the recorder and swings open to reveal construction details, etc. Automatic indicating and recording mechanism, charts, temperature, density, etc., are shown.

ARCH CONSTRUCTIONS — George P. Reintjes Co., 2517 Jefferson, Kansas City, Mo., features its developments in supported arch construction, in a folder recently issued. Advantages are listed and questions and answers point out the adaptability of the arches to various needs. Nine standard combinations are shown in a diagram.

TUMBLING MILL—N. Ransohoff Inc., West Seventy-first street, Cincinnati, has distributed a folder on its line of tum-

(*Continued on Page* 114)

DRACCO DUST COLLECTORS
are COMPLETELY installed under ONE contract

THERE IS NO BUCK PASSING WHEN INSTALLING DRACCO DUST COLLECTORS. The units come complete with no extras to buy. If you wish we can quote one price that covers cost of entire installation including piping, erection, and freight. DRACCO unified responsibility is greatly appreciated by their customers. DRACCO Dust Collectors save money in so many ways that it doesn't pay to tolerate Dust. DRACCO Engineers have over 20 years experience—why not consult them?

Get Bulletin No. 302

7 DRACCO Dust Collectors Installed Complete with ONE Unified Responsibility

Remember !!
DRACCO DUST COLLECTORS are maintained ON THE CLEAN AIR SIDE
WORKED ON FILTER NOT MAINTAINED ON CLEAN AIR SIDE
WORKED ON FILTER MAINTAINED ON CLEAN AIR SIDE

• *Write for Bulletin No. 302* •

DRACCO CORPORATION
4050 E. 116th St., Cleveland, Ohio • New York Office, 130 W. 42nd St.

PNEUMATIC CONVEYORS • DUST COLLECTORS

T. H. Benners, Sr.
T. H. Benners & Co
THE SOUTH

J. W. Miller
Miller & Co.
CHI.-ST. LOUIS-CINN.

F. W. Marshall
F. W. Marshall & Co.
EASTERN SEABOARD

Good Service . . . on GOOD PIG IRON

AMONG the customers of Woodward Iron Company are now numbered enterprises engaged in almost every line of merchant iron use in practically every section of the United States.

Through established sales agencies in every district, the senior officers of which are presented on this page, Woodward maintains close and constant contacts with its customers. And because of its location—nearer to all larger population centers in the country than any other city in the lower South—Woodward is able to make prompt deliveries via nine trunk line carriers, or by rail and water or all water routes to sections which can so be best served.

Woodward Iron Company invites your business on the basis of ability to give you good service on good pig iron—the only commodity it makes.

Nils Anderson
Debevoise, Anderson & Co.
VIRGINIA & EXPORT

H. L. E. Meyer, Jr.
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PACIFIC COAST

L. S. Kerchner
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PITTSBURGH & CLEVELAND

Baylor Hickman
Baylor Hickman & Co.
LOUISVILLE

WOODWARD IRON COMPANY

WOODWARD, ALA.

America's Largest Completely Integrated and Entirely Independent Merchant Iron Producer

INDEPENDENT SINCE 1883

(*Continued from Page* 112)
bling mills. The publisher describes a method of cleaning castings in which the work is suspended in a moving mass of tumbling material and which separates work and stars without manual handling.

BLAST CLEANING—A comprehensive data book, No. 211, on airless abrasive metal cleaning recently has been issued by the American Foundry Equipment Co., Mishawaka, Ind. The book describes the blast cleaning equipment and photographs and descriptive material give details. Installation views illustrate its applications in many types of industry.

ELEVATOR BUCKETS—Link-Belt Co., 307 North Michigan avenue, Chicago, has issued its illustrated folder No. 1435 on its line of steel elevator buckets. A description of the buckets as well as the list prices, dimensions in inches and average weight in pounds, are given. Illustrations of various other types of elevator buckets also are included.

MOTORS—A publication, describing its new line of fan cooled squirrel cage motors, recently has been announced by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. The folder shows the applications and distinctive features of this equipment. A diagram showing the methods of lubrication and ventilation is included.

DUST COLLECTORS—C. O. Bartlett & Snow Co., 6200 Harvard avenue, Cleveland, recently has released its new bulletin No. 79 on dust collectors. That 36-page catalog contains not only a description of the design and operation of the dust collecting system, but in addition has 8 pages of basic technical engineering data relating to air flow through pipes, etc.

CRANKSHAFTS—International Nickel Co., 67 Wall street, New York, has prepared a folder presenting the paper on "Cast Camshafts and Crankshafts," which was presented before a meeting of the New England section of the Society of Automotive Engineers. The text is a reprint from the article as presented in the March and April, 1937, issues of THE FOUNDRY.

REGULATORS, CLEANERS — Ideal Commutator Dresser Co., Sycamore, Ill., has published a bulletin on regulator equipment. Features, typical applications and installations are brought out in an attractive way by description and illustration. Another folder emphasizes its line of portable cleaners with full details on fans, motors, specifications and models.

REFRACTORIES—Quigley Co. Inc., 56 West Forty-fifth street, New York, has issued its bulletin No. 327 on a plastic refractory with insulating properties for use on high temperature equipment. The properties and uses are explained in detail as well as the methods of use and illustrations showing full particulars. A number of the company's other refractories also are described.

DUST CONTROL—W. W. Sly Mfg. Co., 4700 Train avenue, Cleveland, has published its bulletin No. S-85 on the suppression of dust through proper dust control systems. The bulletin describes the hazards and costs attributable to improper dust control in industry. Numerous illustrations show construction and demonstrate the application of various installations of dust filters.

MATERIALS HANDLING—Cleveland Crane & Engineering Co., Wickliffe, O., has prepared a bulletin entitled "How to Plan a Materials Handling System." Information contained gives suggestions on various topics such as making the original lift and carry operation complete, eliminating rehandling, lessening nonproductive time of machine runs, etc.

FOUNDRY EQUIPMENT — "Profitable Modernization for Foundries" is the title of the pamphlet issued by the Dodge Mfg. Corp., Mishawaka, Ind. Pulleys and bearings of the clamp sleeve type, the D-V drive and bearings for abrasive dust conditions are illustrated and described. The company's complete line of power transmission and belt conveyor equipment for foundries is shown in views of typical installations.

RADIANT HEATING—"Malleableizing with the Gas-Fired Radiant Heating Element" is the title of the booklet recently published by the Surface Combustion Corp., Toledo, O. A diagrammatic view of a gas-fired radiant heating element as well as detailed information on the purpose and use of the equipment are included in the publication. An article dealing with annealing of malleable iron also is presented.

DUST EQUIPMENT — Claude B. Schneible Co., 3951 Lawrence avenue, Chicago, has published a new booklet on the installation of dust suppression equipment. The text was written by Hugh E. Keeler, department of engineering research, University of Michigan. Illustrations of testing equipment used, data on the wet method dust collectors made by the company, etc., are included.

GRINDING — Abrasive Co., Philadelphia, recently has published a folder on its line of snagging wheels for foundry grinding operations. The folder includes information on fused crystalline aluminum oxide abrasives, silicon carbide

(*Concluded on Page* 116)

YET
LIGHTER
IN WEIGHT

Terrific tests prove the super-strength of Truscon Alloy Steel Foundry Flasks. One of many tests is illustrated. Thirteen tons of steel were placed on stock flasks selected at random. The entire weight was supported by the flask trunnions. No sign of failure or distortion developed after each test. ● Yet, Truscon Flasks are light in weight. This combination of super-strength and light weight makes Truscon Flasks last longer, speed up production and contribute to profits on the investment. ● Write for FREE Catalog which illustrates how Truscon Alloy Steel Foundry Flasks blanket all requirements.

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TRUSCON
ALLOY STEEL FOUNDRY FLASKS

Are poured daily with
MODERN Improved Bottom Pour Ladles

Clean, hot metal free of slag inclusions, is tapped off the bottom of the ladle; small molds poured just as easily and accurately as the larger ones through the use of MODERN precision bottom pour mechanism operating in an enclosed protective housing; gearing and trunnions operating on anti-friction bearings same as in all MODERN ladles; all binding tendencies eliminated; ladle bowls removable and easily replaced.

It will pay you to investigate these MODERN ladles for efficient operation. Send for latest ladle catalog.

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Covered and Insulated Ladles

Lifetime Geared Ladles

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Sand Conditioning Systems

Patented & Patents Pending

MODERN EQUIPMENT COMPANY

PORT WASHINGTON, WIS., DEPT. 135

MODERN EQUIPMENT CO.

ADVERTISING PAGES OMITTED

(*Concluded from Page* 114)

abrasives, vitrified wheels for cool and free cutting, a synthetic resin bonded snagging wheel for high speed equipment, abrasive cut-off wheels and some factors influencing snagging operations.

HEAT—Johns-Manville, 22 East Fortieth street, New York, recently has published a new handbook entitled "Heat," which presents a dramatic story of man's age-old struggle to control nature's most powerful forces. The handbook is divided into five chapters covering history, discovery of what heat is, the science of heat conservation, and modern materials available for conserving heat. The booklet is well illustrated.

DUST ARRESTER—Northern Blower Co., 6409 Barberton avenue, Cleveland, has published a pamphlet on its line of bag type dust arresters. The text includes information on the various features of the unit, construction, operation and specifications, together with a table on dimensions and capacities. A similar booklet describes its line of round type air filters with diagrams showing arrangements of hoppers.

INSULATING BRICK—Twelve types of industrial furnaces for which the new insulating brick was developed, are illustrated in a pamphlet published by Johns-Manville, 22 East Fortieth street, New York, entitled "Lower Furnace Costs with Johns-Manville JM-20 Insulating Brick." The furnace drawings clearly show the application of the brick to each type furnace. An important feature of the pamphlet is the table giving the heat losses transmitted through fire brick walls bare and insulated. Also defined are the physical properties of the brick and a discussion of its various uses.

CUTTING TOOLS—Haynes Stellite Co., division of the Union Carbide & Carbon Corp., 205 East Forty-second street, New York, has published a 52-page book with over 60 illustrations of tools and machining operations. Recommended speeds and feeds for machining a variety of materials, methods of obtaining longer tool life, and description of jobs being performed by the company's tools are three of a series of pertinent subjects discussed in the book.

CARRIERS — Numerous photographs showing various types of hand propelled carriers with motor operated hoists, feature the brochure issued by the Cleveland Tramrail division of the Cleveland Crane & Engineering Co., Wickliffe, O. Carriers are shown for specific conditions and the parts used in the complete assembly are catalogued and shown in closeup views. Outstanding points of design, control of hoist motions and capacity ratings are given.

CONVEYORS—Logan Co., Louisville, Ky., has published a 24-page catalog dealing with gravity and power conveyors for handling flasks through molding pouring, cooling and storage, as well as for handling tote-pans through cleaning, grinding, and machining operations. The catalog has numerous illustrations of modern conveyor systems as well as sketches and engineering data of considerable value to engineers and operating men.

FURNACES — Metal melting furnaces made interchangeable for gas or oil are described in a booklet issued by the Campbell-Hausfield Co., Harrison, O. The various types of furnaces are illustrated and described in detail and engineering data and specifications are included for each. The catalog also treats the company's centrifugal low pressure blowers, motor driven oil pumping units, iron flask plates, gas fired ladle heater, ingot mold rails, metal skimmers, burner nozzles and oil strainers.

ACCOUNTING FORMS — Charles R. Hadley Co., 330 North Los Angeles street, Los Angeles, has sent out a complete and comprehensive book on its accounting forms and systems. The system service, bank and trust research, governmental research and educational departments are described fully. Sections in the back of the book are devoted to a listing of the company's products, grouped according to related functions of business, specific lines and general applications.

GRINDERS—Vonnegut Moulder Corp., 1815 Madison avenue, Indianapolis, has published a detailed booklet on its line of heavy duty grinders and buffers. Several illustrations are included which show automatic adjustment of wheel guards, 10, 12 and 14-inch pedestal type grinders, heavy duty floor grinders, multiple speed stand grinders and a constant cutting speed grinder. Full details of the constant speed mechanism are given and complete specifications and engineering data are included.

REFRACTORY CEMENT — Refractory & Insulation Corp., 381 Fourth avenue, New York, recently has published a bulletin on its No. 300 refractory cement for bonding at high or low temperatures. The publication presents information on the uses of the material, while illustrations show results of using the cement in resetting brick, methods of applying, and interesting views. Castable refractories and a plastic insulation also are described.

And Transite Core Plates not only increase production capacity . . . but provide protection against breakage, warpage and corrosion

Johns-Manville TRANSITE CORE PLATES

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THERE'S REAL ECONOMY in using *lightweight* core plates! They make for easier handling . . . step up production . . . and sizably reduce your labor and maintenance expense.

Johns-Manville Transite Core Plates weigh only about a quarter as much as metal of equal thickness. This means that a foundry worker can handle twice as many plates in less time and with considerably less effort.

Transite's other advantages are equally important. Made of a specially treated asbestos-cement combination, these durable core plates cut down on breakage losses. Being non-metallic, they *cannot corrode* . . . they retain their smooth surface year after year. And warping is practically eliminated.

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